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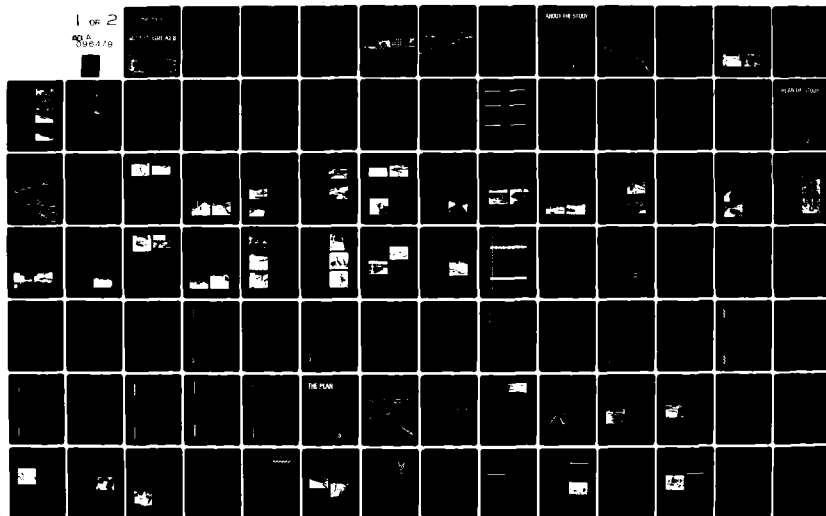
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Main Report

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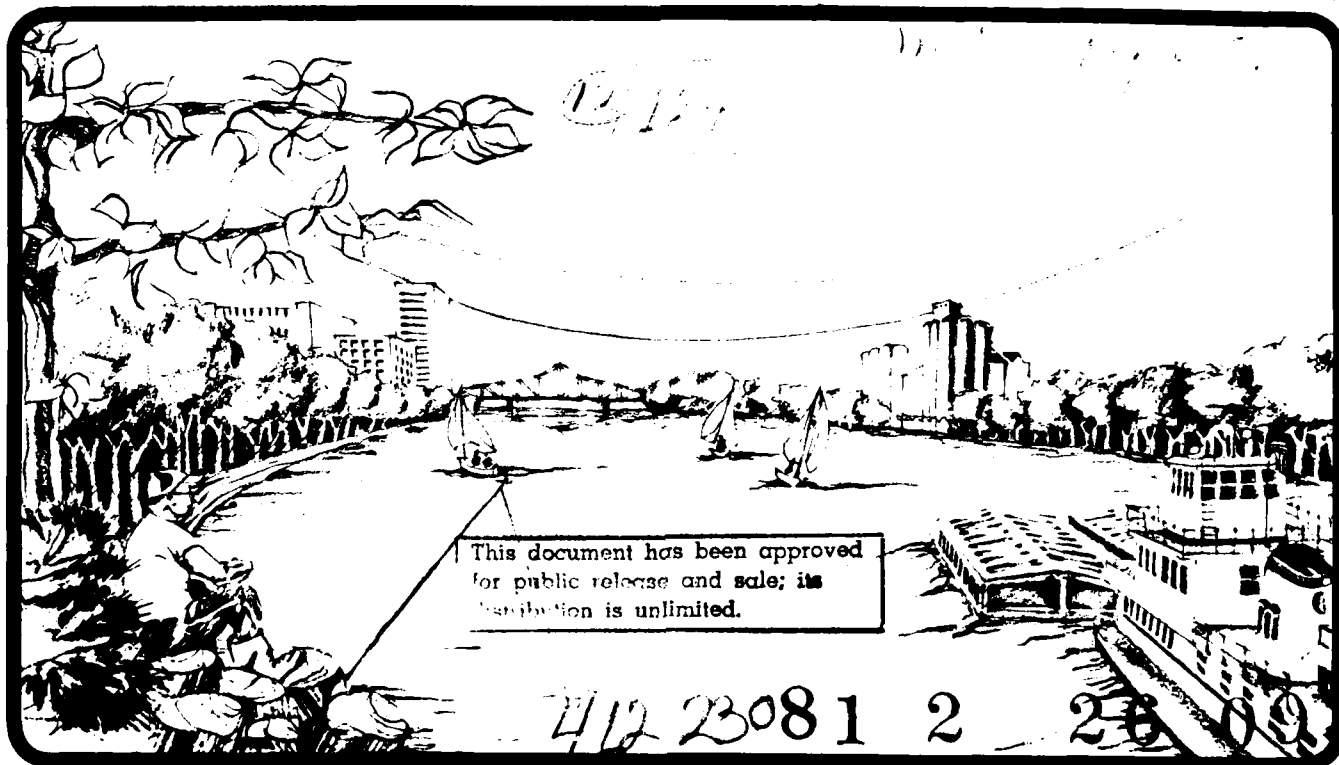
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Great River Environmental Action Team

DECEMBER
1980

GREAT II

Upper Mississippi River
(Guttenberg, Iowa to Saverton, Missouri)



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Great River Environmental Action Team

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I AM MISSISSIPPI

EONS OLD

*I am fickle in causing misery;
Cruel and treacherous when I want to be.
Other times my waters teem
With cargoes floating down my stream;
I aid farms along my way
By irrigating corn and hay;
I give power to the Mills.
I am older than the hills...Eons old.*

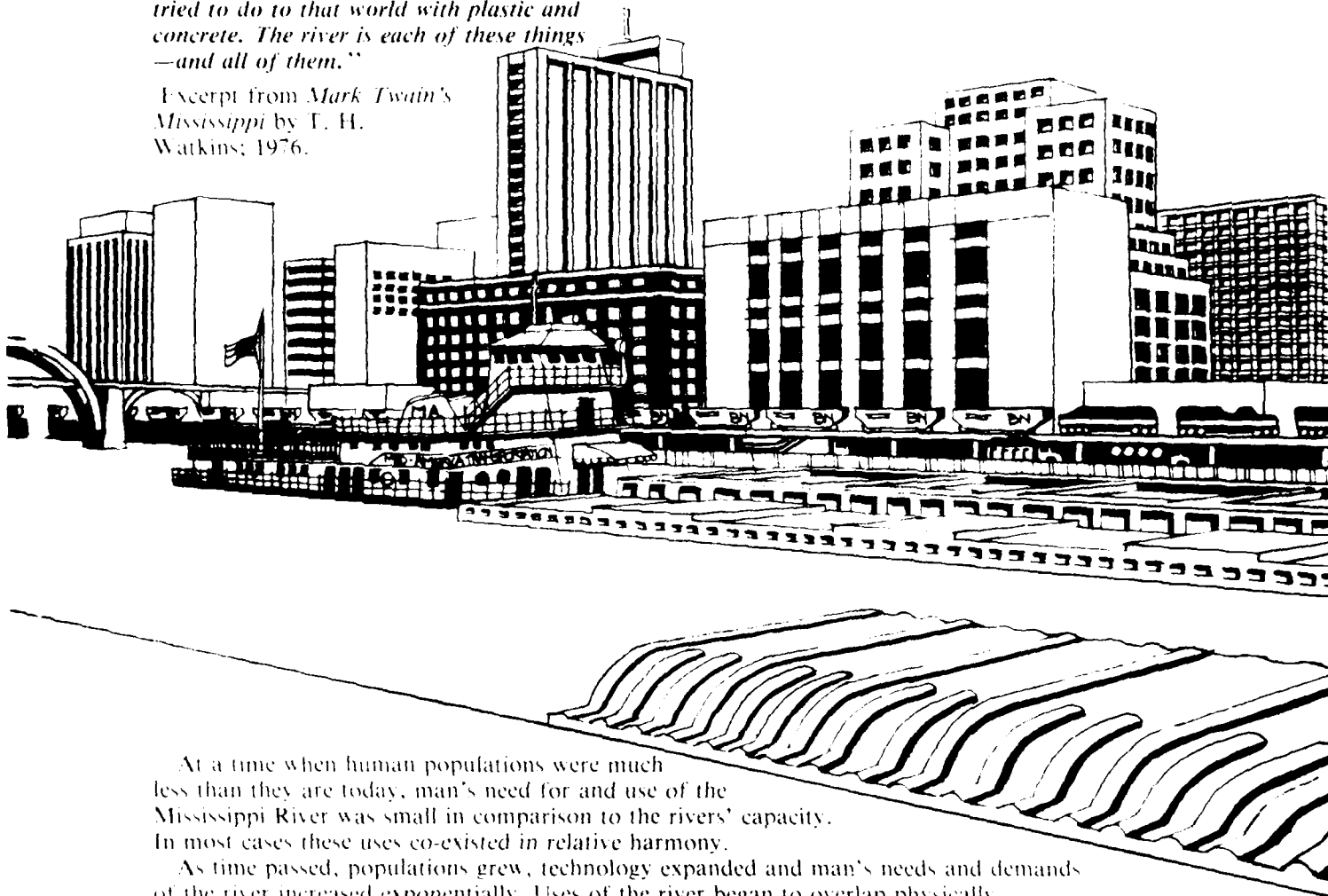
Hazel Dufresne

PREFACE

T. H. Watkins said in *Mark Twain's Mississippi*:

"The Mississippi today does not lend itself to easy definition, for it is as vulnerable as any other geographic phenomenon to the consistent inconsistencies of human use and interpretation. Its meaning, if not lost entirely, is at least confused by all the cater-wauling bustle of this end of the twentieth century. Men see this river as they want to see it: For some it is the great road of commerce, the artery of progress and enterprise, the heartline for an industrial civilization. For others it is a river of memory, rich with the ghosts of a time called history, a simpler, more understandable, more human time. For yet others it is a recreational resource, an escape hatch from the pressures of a more complicated world, a place for lazing in the sun, boating, water-skiing, fishing and hunting. And for those who would preserve what has so far been left untouched, it is an abundant natural force whose existence can serve to remind us from time to time that we are, after all, natural creatures living in a natural world, no matter what we have tried to do to that world with plastic and concrete. The river is each of these things—and all of them."

Excerpt from *Mark Twain's Mississippi* by T. H. Watkins; 1976.

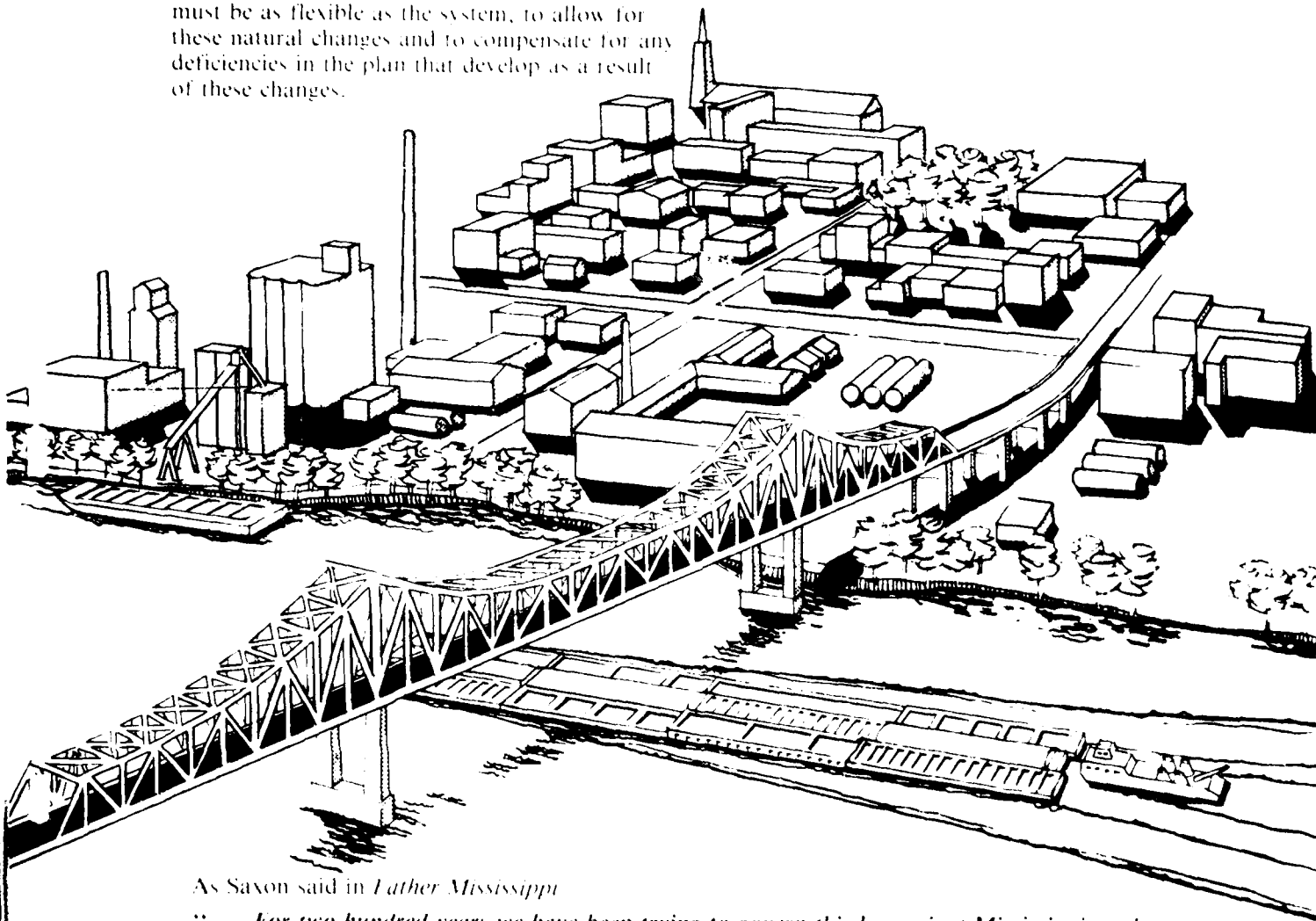


At a time when human populations were much less than they are today, man's need for and use of the Mississippi River was small in comparison to the river's capacity. In most cases these uses co-existed in relative harmony.

As time passed, populations grew, technology expanded and man's needs and demands of the river increased exponentially. Uses of the river began to overlap physically as well as philosophically.

The idea of multiple-uses of the resources in a given area evolved by necessity as various river uses began to encroach upon each other. Although there are portions of the UMR dedicated primarily to a single purpose (i.e., Fish and Wildlife Refuges), the majority of the lands along the UMR support a wide variety of uses and interests.

As we review this document and realize the dedication of those who participated in its development, we must also realize that this job of planning for the river uses and needs will never be completed. The Mississippi River is the product of the continuous changes inherent in any natural system. A plan to manage the river must be as flexible as the system, to allow for these natural changes and to compensate for any deficiencies in the plan that develop as a result of these changes.



As Saxon said in *Father Mississippi*

"... For two hundred years we have been trying to govern this lazy, giant Mississippi, and for two hundred years we have had but mediocre success. It is a gorgeous river—a mile wide, swirling slowly down to New Orleans, with palms sticking spiky fingers into the current and hyacinths damming the bayous. Its current is only about five miles an hour. To one who watches the river in its indolent seasons it seems impossible that this is the lustful enemy that men have fought, whipped to frenzy by a sense of their own impotence.

But this is the Mississippi, giver of the Valley's wealth and the Valley's desolation, strong, slow, deceptive. Whether or not we shall learn to govern the river remains to be found out. But though it can be cajoled, it cannot be forced, and whatever is done must be done according to its own way, giving it the only thing it really wants—a royal road to the Gulf."

Excerpt from *Father Mississippi* by Saxon; 1927.

ABOUT THE STUDY

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*"Standing at the summit of the ecological
pyramid, man alone can look backward
billions of years and contemplate himself"*

Sigurd Olson

STUDY BACKGROUND

The people of the Upper Midwest have long recognized that the Upper Mississippi River is one of the largest, most diverse, most productive river environments in the world. Man, in his progress, however, has put the river to many varied and sometimes conflicting uses. The pressures of man's use of the river are feared to be degrading the environmental qualities of the rivers' resources. The U.S. Army Corps of Engineers' (COE) 9-foot navigation channel project, authorized by Congress in 1930, has had the most influential effect on the natural character of the Upper Mississippi River, and its usefulness for other purposes, in the past 45 years.

Under threat of lawsuit initiated against the COE by the State of Wisconsin in 1973, the COE prepared an environmental impact statement (Upper Mississippi River 9-foot Navigation Channel; Environmental Impact Statement) in accordance with the National Environmental Policy Act of 1969. The statement dealt with the possible effects of the operation and maintenance program on the Upper Mississippi River. This document revealed that current methods of channel maintenance, especially dredging and deposition of dredged materials, were damaging the fragile backwaters, marshes and sloughs for which the river is famous. The environmental impact statement also revealed that little information was available on the complex interactions of the river's resources and these resource reactions to man's activities on the river. The lack of information would make it almost impossible for government agencies or Congress to evaluate alternative means of managing the river in a more

balanced way without considerable additional study. The information, when and if obtained, could be used to determine where problems exist and the alternatives available to man to solve these problems and coordinate river uses to minimize conflicts.

As a result of growing congressional and public interest in the Upper Mississippi River management problems, the North Central Division Engineer of the COE and the North Central Regional Director of the U.S. Fish and Wildlife Service announced in September, 1974, that they planned to establish a partnership team. The team would work out long-range management strategy for the multi-purpose use of the river. This move soon led to organization of a broad-based interagency task force. The Upper Mississippi River Basin Commission (UMRBC) had established a special Dredged Spoil Disposal Practices Committee several months before to begin laying the groundwork for a cooperative effort. This committee was composed of delegates representing the five principal river basin states and five key resource-oriented federal agencies.

Thus, what finally became known as the Great River Environmental Action Team (GREAT) was set up in October, 1974, as a working partnership of Federal agencies and States under the auspices of the Upper Mississippi River Basin Commission.

AUTHORITY

The Great River Study was authorized by Congress in the Water Resources Development Act of 1976 (PL94-587). This legislation authorized the U.S. Army Corps of Engineers "... to investigate and study, in cooperation with interested States and Federal agencies,

through the UMRBC, the development of a river system management plan in the format of the 'Great River Study' for the Mississippi River from the mouth of the Ohio River to the head of navigation at Minneapolis, incorporating total river resource requirements including, but not limited to, navigation, the effects of increased barge traffic, fish and wildlife, recreation, watershed management, and water quality at an estimated cost of \$9,100,000."

The total study program as developed by the COE included two Great River Environmental Action Teams (GREAT), which have the responsibility for the river reaches from St. Paul/Minneapolis, Minnesota to Guttenberg, Iowa (GREAT I); Guttenberg to Saverton, Missouri (GREAT II); and the Great River Resource Management Study which is responsible for the river from Saverton to the confluence of the Ohio River (GREAT III). See Figure 1.

PURPOSE

The Great River Study was an attempt to resolve conflicts arising from multiple demands on a valuable national resource. The overall goal of the study was to present to Congress and the people a river resource management plan that was, above all, realistic—a plan that was technically and economically sound, socially and environmentally acceptable, and capable of being put into action within a reasonable period of time.

In addition, the plan should provide for multiple-use management on the UMR. It

should be comprehensive in terms of all the multiple uses we rely on the river to provide. The plan should present this multi-use management strategy so that the use of all the Upper Mississippi River resources can be managed in a combination which will provide the widest spectrum of benefits to the public without impairment and degradation. It should include consideration of the relative scarcity of the various finite resources so that it is not necessarily limited to the combination of uses that would give the greatest dollar return or the greatest unit output.

Nowhere is this concept, and its necessity, more appropriate than the Upper Mississippi River. It is a unique resource. This river performs a wide variety of functions for all Americans, among them providing recreational opportunity and navigation capability; supplying water for industries, utilities and human consumption; diluting waste products; and buffering flood flows. It is one if not the only dual purpose mandated resource in this country, as Congress has legislated it to be both a navigation project and a national wildlife and fish refuge. The economic values this system provides must be maintained, but in a manner so that the environmental integrity is preserved. This requires recognition of the tolerance the natural system can withstand without irreversible deterioration. As the environmental threshold can be hidden over time, safeguards must be instituted to prevent the surpassing of that threshold.

Realizing the immensity of this task, GREAT II has operated under the following policies since early in the study.

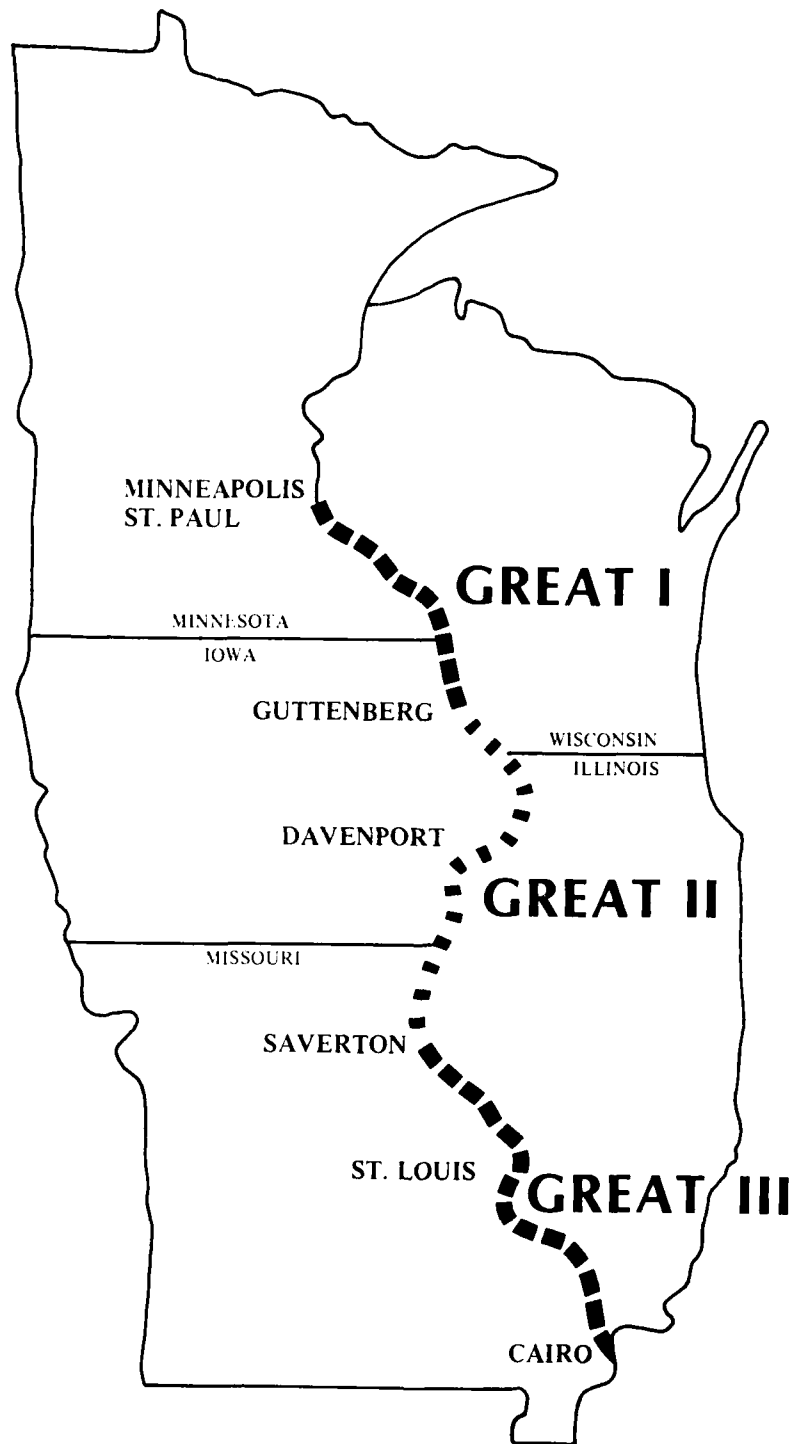


The river is an important link in our nation's inland commercial navigation system.



Recreation is a major use of the river system.

FIGURE #1
GREAT I, II AND III STUDY AREAS



"The GREAT II Study will address all elements of a total river resource management plan; resolve as many of those elements as possible, but will produce a plan to resolve the element of an environmentally and economically acceptable channel operation and maintenance program. If, by the time of the final report, a particular element cannot be resolved, the report will put forth what must be done to resolve that element."

SCOPE

The scope of the problem resolution in the GREAT II studies focused on channel maintenance activities and their associated biological, economical and social impacts. Other problems addressed by the GREAT II studies dealt with activities on the Upper Mississippi River, or those resources affected by activities on the river.

Where possible, the recommendations specify the type of project action needed or the additional studies which must be completed before specific action can be taken.

The geographic scope of the GREAT II study was limited to 314 miles of the Upper Mississippi River from Guttenberg, Iowa to Saverton, Missouri. These river boundaries coincide with those of the Rock Island District of the U.S. Army Corps of Engineers. (see Figure #2)

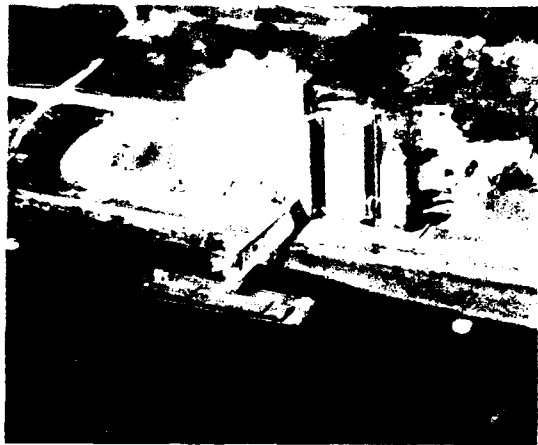
The study area was defined as the river itself, the backwater areas, and the land on either side contained within the counties immediately adjacent to its waters. The area includes 23 counties within the four states of Iowa, Illinois, Wisconsin and Missouri.¹

The GREAT II Study was intended to address management needs and recommend implementation strategies for these needs up to and including the year 2025.

¹ Studies conducted by the GREAT II Sediment and Erosion Control Work Group (SECWG) encompassed a much larger study area than most of the studies conducted for GREAT II. The SECWG study area included the entire hydrologic drainage area of the Upper Mississippi River (UMR). As the SECWG study area was extensive (approximately 55,000 square miles) and as it only applied to a limited number of studies, the land base used to determine the resource condition, including population and land use estimates, included only those counties immediately adjacent to the GREAT II reach of the UMR.



The river serves as an integral part of an international migratory waterfowl route.

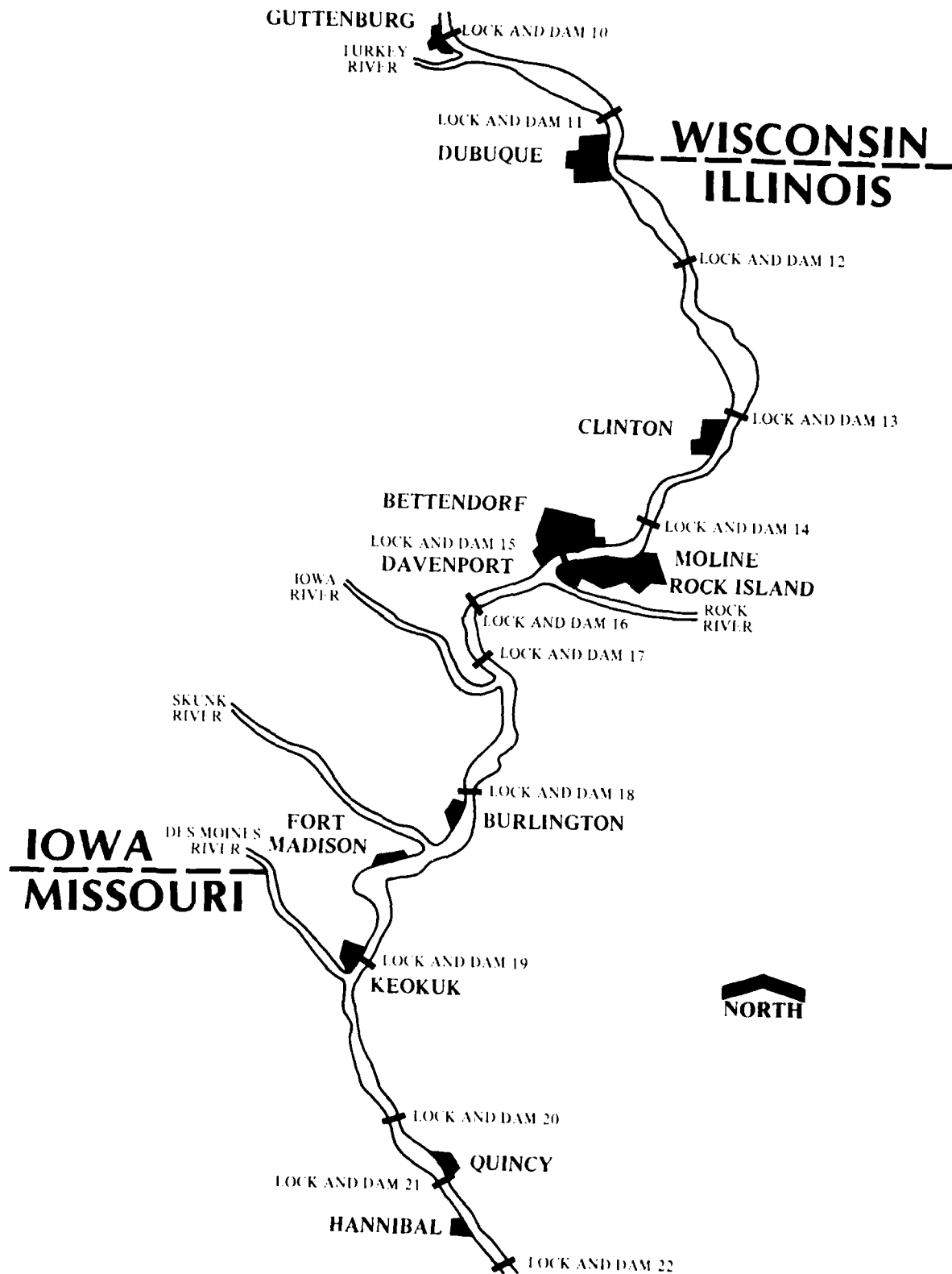


The shoreline of the river is developed in many places for industrial uses.



To maintain the navigation system the Corps of Engineers must annually dredge material and remove it from the channel.

FIGURE #2
GREAT II STUDY AREA



STUDY ORGANIZATION

PARTICIPANTS

Participants in the GREAT River study included Federal, State, regional and local agency representatives, as well as the general public.

Figure #3 shows the organization of agency and public representation for the GREAT river study in general. The representatives and/or participants and their respective roles as they related *specifically* to GREAT II are explained in the following paragraphs.

TEAM

The GREAT II Team was composed of representatives from the following Upper Mississippi Basin States and the Federal river resource-oriented agencies—

- State of Illinois
- State of Iowa
- State of Missouri
- State of Wisconsin
- U.S. Department of the Interior—Fish and Wildlife Service
- U.S. Department of Agriculture—Soil Conservation Service
- U.S. Department of Defense—Department of the Army—Corps of Engineers
- U.S. Department of Transportation—U.S. Coast Guard
- U.S. Environmental Protection Agency
- Upper Mississippi River Conservation Committee (ex officio)

The role of the Team was to make final recommendations as a result of the GREAT II studies, to pass on to the Rock Island District, Corps of Engineers and eventually to Congress. (Figure #3 shows the paths that the final GREAT II report will take on its way to Congress.) The Federal Team members were to represent their agency viewpoint at this step in the decision making process. The State Team members were to represent the collective viewpoint of all participating agencies from within their respective state.

Members of the Team participated as equal partners. For organizational purposes the GREAT II team was co-chaired by representatives from the U.S. Army Corps of Engineers and the State of Iowa. The equal partnership Team had one voting member

from each State and Federal agency involved. The Team met at mutually agreed upon times to report on study assignments and to monitor general study progress. The Team operated under the bylaws of the UMRBC which required that attempts should be made to settle all issues unanimously. However, if all members could not agree, an issue could be decided by a majority vote of Federal representatives and a majority vote of State representatives.

INTERNAL OVERVIEW COMMITTEE

The Internal Overview Committee (IOC) consisted of representatives from the four states and a representative of the Corps of Engineers and the Fish and Wildlife Service. The committee functioned as an advisory board to the Team. One of its duties was to recommend how GREAT II funds should be spent to best accomplish the study objectives. The U.S.F.W.S. chairs the Internal Overview Committee.

PLAN FORMULATION WORK GROUP

The Plan Formulation Work Group (PFWG) was composed of the chairman of each of the 12 functional work groups (see section on functional work groups for more information) and representatives from those participating states which did not chair a work group. Although Missouri and Illinois, at various points throughout the study did not chair a work group, Wisconsin was the only state which did not chair a work group.

The role of the GREAT II PFWG was to coordinate the activities of all of the functional work groups and to organize the findings, conclusions and recommendations of each of the functional work groups into a comprehensive recommended plan, to be submitted to the GREAT II Team.

Members of the GREAT II PFWG were to represent the views of the functional work group they chaired while at the same time, identifying acceptable trade-offs that would provide for management of *all* of the Mississippi's resources.

As with the Team, members of the PFWG attempted to settle all decisions unanimously. In some cases unresolved issues were passed on to the GREAT II Team for resolution at an

agency, rather than a resource level. The PFWG prepared a technical appendix to the GREAT II final report that summarized the technical data and processes used to develop the Great II recommended plan and reports. The GREAT II work groups and their chairmen were as follows:

TABLE I

WORK GROUP	CHAIRMEN
Commercial Transportation	Department of Transportation; U.S. Coast Guard
Cultural Resources	State Historical Department of Iowa; Division of Historic Preservation
Dredged Material Uses	Iowa Geological Survey
Dredging Requirements	Corps of Engineers
Fish and Wildlife Management	U.S. Fish and Wildlife Service
Floodplain Management	Missouri Department of Natural Resources
Material and Equipment Needs	Corps of Engineers
Public Participation and Information	Private citizens and public interest groups; private contractor
Recreation	Iowa Conservation Commission and Illinois Department of Conservation
Sediment and Erosion Control	Soil Conservation Service
Side Channel	U.S. Fish and Wildlife Service
Water Quality	Missouri Department of Natural Resources

The GREAT II PFWG was chaired by the Iowa Conservation Commission.

FUNCTIONAL WORK GROUPS

The GREAT II functional work groups (see Table 1) identified problems, conducted studies, formulated conclusions and alternative solutions, and developed recommendations to best manage their respective areas of concern. Each work group prepared a report summarizing their activities, findings, and recommendations. These 12 reports are also appendices to the GREAT II final report and were used extensively in the preparation of this report.

Government and private interests that were not formal Team members were invited to participate in the activities of all work groups.

POLICY

The policy that guided and directed the

GREAT II study was provided by the Great River Study committee of the UMRBC (see Figure 3).

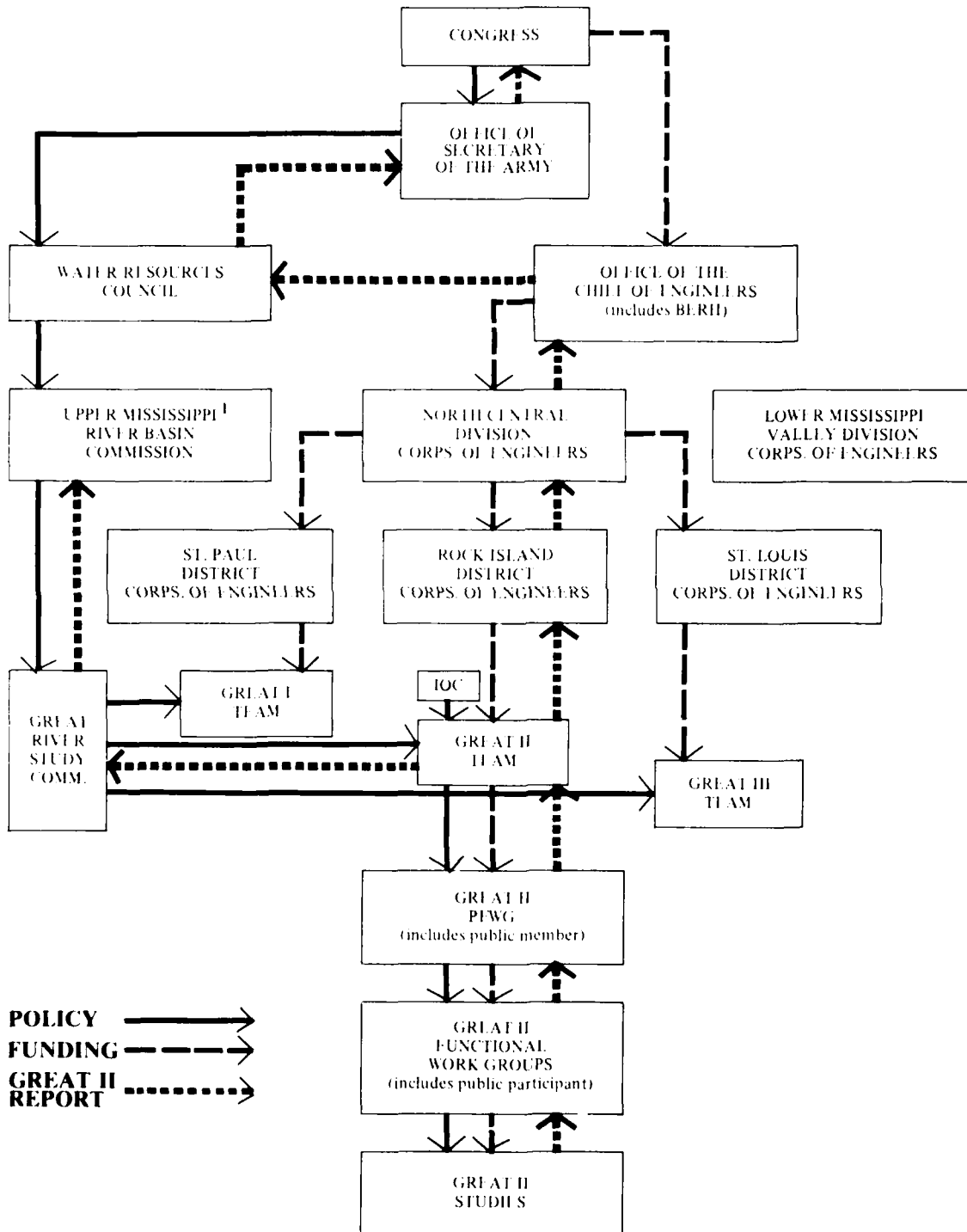
Specific regulations that guided the GREAT II study are discussed in a later section of this chapter.

FUNDING

Figure #3 shows the routing of the funds from Congress, through the Corps of Engineers to their Rock Island District and finally on to the GREAT II Team.

Although the Team had the final decision in budget matters, the PFWG first approved the concept of dollar expenditure. Concept approvals were needed on all proposed studies and/or scopes of works for proposed studies. Funding proposals for the work group chairmen's participation were also voted on by the PFWG. A study budget is shown in Table II.

ORGANIZATION OF GREAT II POLICY AND FUNDING



Elements of this report (or this entire report) which are incorporated into the UMRBC Comprehensive Coordinated Joint Plan (CCJP) may be submitted directly from the Water Resources Council to Congress.

TABLE II
GREAT II FUNDING SCHEDULE
(thousands of dollars)

ELEMENT	FY 77	FY 78	FY 79	FY 80	WG TOTAL
CTWG	0	130.0	15.0	16.0	161.0
CRWG	8.0	0	1.0	0	9.0
DRWG	0	67.0	52.0	56.0	175.0
DMUWG	12.0	48.0	47.0	35.0	142.0
F&WMWG	8.0	74.0	201.0	81.0	364.0
FPMWG	1.0	31.0	36.0	34.0	102.0
MENWG	0	7.0	13.0	60.0	80.0
PPIWG	19.0	58.0	55.0	56.1	188.1
RWG	11.0	21.0	97.0	7.0	136.0
SECWG	10.0	59.0	102.0	5.0	176.0
SCWG	20.0	43.0	108.0	21.0	192.0
WQWG	0	29.0	134.0	25.0	188.0
PEWG	5.0	54.0	70.0	244.9	373.9
Contracting (CofF)	24.0	62.0	91.0	44.0	221.0
Administration (CofF)	57.0	42.0	108.0	113.0	320.0
FY TOTALS	175.0	725.0	1130.0	798.0	2828.0

NOTE: Participating agencies have absorbed costs and these are not included in the above figures.

STUDY GUIDANCE

A complex study such as the GREAT River Study must follow a multitude of regulations. In addition the study must be aware of and responsive to the activities of other and related studies.

The following sections summarize the studies that were closely related to the GREAT II study and the major regulations that guided development of the GREAT II study process.

RELATED STUDIES

Cognizance of and coordination with other related studies helps to avoid duplication of efforts and widens the scope of reference in any study. The GREAT II study is no exception. Presently, there are four studies that are closely tied to one another and to the GREAT II study. These are the GREAT I and GREAT III Studies, the Main Stem Level B study and the UMRBC Master Plan. The information gathered and recommendations made in each of these studies will eventually be organized and combined in order to more completely develop a management plan for the entire Upper Mississippi River. The Master

Plan Study is presently responsible for completing this plan.

Although the three GREAT Teams have coordinated their study efforts, there may be inconsistencies between the findings, conclusions and recommendations of the three respective reports. These inconsistencies may be due to:

- differences in physical characteristics between the three areas
- differences in management philosophies of the participating agencies from within the three study areas
- differences in environmental, social, and economic values from agencies and the public within the three studies.

It is the responsibility of the Team members from the three GREATs to evaluate and try to resolve these differences. Differences which have not been resolved by the time the three GREATs have been completed will be handled by the Great River Study Committee of the UMRBC.

Table III lists other studies which have been undertaken or are ongoing on the Upper Mississippi River which relate to or affect the GREAT II studies.

**TABLE III
RELATED STUDIES**

STUDY TITLE	RESPONSIBLE AGENCY	STATUS
Nine-foot Channel EIS	Rock Island District, Corps of Engineers	Complete
Comprehensive Basin Study	Upper Mississippi River Basin Commission	Complete
Twelve-foot Channel Feasibility Study	North Central Division, Corps of Engineers	Complete
Proposed Wilderness Areas Study	Fish and Wildlife Service	Complete
Lock and Dam 26 Replacement EIS	St. Louis District, Corps of Engineers	Complete
Resource Management Plan	Rock Island District, Corps of Engineers	Complete
Upper Mississippi River Water Surface Profiles, Mile 0.0 to 847.5	Rock Island District, Corps of Engineers	Complete
Refuge Master Plan	Fish and Wildlife Service	Ongoing
Great River Road	States, Federal Highway Administration	Ongoing
Main Stem Level B Study	Upper Mississippi River Basin Commission	Ongoing
Assessing Flood Damage Potential	Rock Island District, Corps of Engineers	Ongoing
Biological/Recreational Studies	Upper Mississippi River Conservation Committee	Ongoing
Recreational Craft Locks Feasibility Study	St. Paul District, Corps of Engineers	Ongoing
Quad City Urban Study	Rock Island District, Corps of Engineers	Complete
Mississippi Year-Round Navigation Feasibility Study	Rock Island District, Corps of Engineers	Complete
GREAT I Study	St. Paul District, Corps of Engineers	Complete
GREAT III Study	St. Louis District, Corps of Engineers	Ongoing
The Master Plan (PL 96-502)	Upper Mississippi River Basin Commission	Ongoing

PERTINENT REGULATIONS.

The decision-making and plan development process developed for the GREAT II study reflected the many planning rules and regulations of the various participating agencies. The most important of these regulations are discussed below.

WATER RESOURCES COUNCIL. The Water Resources Planning Act of 1965 granted the Water Resources Council the authority to coordinate with other Federal water resource planning departments. Better coordination among these Federal agencies was necessary in order to improve the nation's water resources plans and programs. Congress, in particular, wanted to improve the analytical process for making decisions about river basin and project developments. The Act of 1965 specifically instructed the Water Resources Council to establish "principles, standards and procedures," which would apply to all federal agencies.

Principles and Standards (P&S) were built around the concept and process of multiple objective planning. The "Principles" provide the broad policy framework for planning activities and include the conceptual basis for planning. The "Standards" provide for uniformity and consistency in planning.

Under these proposals, planning for the use of the nation's water and land resources is directed toward improvement in the quality of life through contributions to national economic development and environmental quality.

U.S. ARMY CORPS OF ENGINEERS. As the GREAT II Study is funded through the COE, the final report adhered to applicable COE rules and regulations as well as other applicable Federal regulations. The COE has developed Engineering Regulations in response to the Water Resources Council's "Principles and Standards," and were therefore used as the main planning guide in the development and writing of the GREAT II Study and final report.

OTHER REGULATIONS. As this study was an interagency study, an attempt was made to observe the planning rules and regulations of the other participating agencies. Contacts with agency representatives revealed no major conflicts with or variations from those that the COE is presently using.

However, there were several other Federal regulations, applying to Federal resource projects, which had to be addressed. Two of the more important of these are listed below:

- **National Environmental Policy Act of 1969** (PL91-190)

This Act requires Federal agencies to prepare an environmental document on all proposed actions which could significantly affect the quality of the human environment.

- **Federal Water Pollution Control Acts of 1972** (PL92-500) as amended by the **Clean Water Act of 1977** (PL95-217).

These Acts require that the environmental impacts of the disposal of dredged and fill material in the nation's waterways be assessed and permits for such activities issued only when they "... will cause only minimal adverse environmental effects when performed separately, and will have only minimal cumulative adverse effects on the environment."

STUDY PROCESS

GREAT II developed and utilized a complex decision-making process to prepare their final recommended plan. This section explains the process starting at the work group level, and leads the reader through the formulation and evaluation of alternative plans to finally, the preparation and synthesis of the recommended plan. Figure #4 summarizes the GREAT II planning process.

Each functional work group was responsible for certain elements of the process, and specific items or detailed discussion concerning these elements may be found in respective work group appendices. The PFWG Technical Appendix contains the entire process description, in detail, including all criteria, flow charts and forms developed to guide the process.

As specified in "Principles and Standards," there were three stages of planning necessary in the development of a study. These are:

STAGE 1—Development of Study Plans

STAGE 2—Development of Intermediate Plans

STAGE 3—Development of Final Plans

At each stage of the planning process, there were four functional tasks to be accomplished:

- Problem identification
- Formulation of alternatives
- Impact assessment
- Evaluation of alternatives

This general process outline allowed the

flexibility for new problems or alternatives to be identified and considered long after the project had begun.

STAGE 1

The emphasis in Stage 1 was on problem identification and formulation of objectives. The work groups identified problems, conflicts and concerns which related to their overall area of expertise. A work groups' list of problems was composed of those problems identified in any of the following ways:

- The problem was identified in GREAT I and was applicable to the GREAT II area.
- The particular work group recognized an existing problem based on existing conditions.
- The particular work group recognized a potential problem based on future projections of existing conditions and trends.
- Other work groups identified concerns relating to the particular work groups' area of study.
- The public expressed concerns and problems directly to the particular work group.
- The public expressed concerns and problems to a particular work group through the Public Participation and Information Work Group (i.e., town meetings, houseboat trips, etc.).

These problems were compiled into a list to be evaluated by the particular work group for their relevancy to the study; the urgency or certainty of the problem; and the potential for resolving the problem within the time-frame of the study. Certain problems were eliminated from further study based on criteria/guidelines developed by the UMRBC in 1974. (See PFWG Appendix for list of criteria.)

Once the work groups had developed a set of problems and needs, they formulated a list of objectives designed to address and, at a minimum, partially resolve their problems. These objectives were then used to identify tasks and/or studies which the work group needed to accomplish in order to identify the possible alternative solutions to their respective problems. The problems, objectives and tasks therefore represent the plans-of-

FIGURE #4
GREAT II PLANNING PROCESS

STAGE ONE

October 1976

WORK GROUPS

with guidance from PFWG and TEAM

↓
IDENTIFY PROBLEMS
DEFINE OBJECTIVES
DEVELOP TASKS
↓

PLAN OF STUDY

April 1978

STAGE TWO

WORK GROUPS

with guidance from PFWG and TEAM

↓
COLLECT INFORMATION
COMPLETION OF TASKS
↓

PRELIMINARY FEASIBILITY REPORT

September 1978

↓
RESULTS AND CONCLUSIONS
IDENTIFICATION OF ALTERNATIVE SOLUTIONS
SELECTION OF WORK GROUP RECOMMENDATIONS
IMPACT ASSESSMENT OF RECOMMENDATIONS
↓

January 1980

STAGE THREE

PFWG/NED/EQ
↓

PFWG
↓

DEVELOPMENT OF ALTERNATIVE PLANS

EVALUATION OF RECOMMENDATIONS

↓
DRAFT RECOMMENDED PLAN

May 1980

↓
PUBLIC AND AGENCY REVIEW OF DRAFT RECOMMENDED PLAN
PLAN MODIFICATION
↓

FINAL GREAT II RECOMMENDED PLAN

December 1980

action each work group used to derive their final conclusions and recommendations. (see PFWG appendix for more detailed information).

The work group plans-of-action were reviewed by the PFWG and the public. Changes were made where necessary. The final product for Stage 1 was a Plan of Study for GREAT II; published in June, 1977.

STAGE 2

The tasks that each work group chose to accomplish varied by work group, by type of problem they were addressing and by the existing knowledge they had about that problem. All work groups needed to collect and organize background information. This background information was used to develop existing and future (most probable without GREAT) conditions.

This information was also used to document problems and/or data gaps. The existing and future conditions were developed for the general study area and also for each pool within the GREAT II area. (Detailed conditions for any particular work group's area of study may be found in their respective appendices. Summaries of the existing and future conditions may be found in the PFWG appendix.) The year 1979 was chosen as a base point for depicting existing conditions. The year 2025 was used as the base point for predicting future conditions.

Where little background data existed, baseline data was collected and/or research studies conducted.

As the studies progressed, tasks completed, and conclusions made, the emphasis in Stage 2 shifted.

A "Preliminary Feasibility Report" was prepared to show the progress of Stage 2. This report was published in September, 1978.

The conclusions developed by each work group led to the identification and consequent development of potential alternatives to their problems.

The results of *some* tasks indicated that there still was not enough available information to ensure a knowledgeable assessment of the potential alternative solutions to a problem. In these cases, no alternatives could be formulated and the only recommendation which could be made was for further study of the problem. When com-

pletion of work groups tasks led to identification of potential solutions, the alternatives were displayed on a worksheet.

In summary, the worksheet contained the following information about the alternatives: problem addressed (general and/or specific), objectives fulfilled, tasks completed to obtain the necessary information, list of alternatives, references used to select an alternative, rationale for elimination of other alternatives, and a preliminary impact assessment. (These worksheets may be found in each work group appendix accompanying each work group recommendation).

When the worksheet was complete, the work group voted (voting procedures varied by work group and may be found in work group appendices) on the selected alternative. If the selected alternative was approved by the work group, it was given a work group number and became a work group recommendation.

In an attempt to satisfy NEPA regulations for a broad planning document such as this, each work group was required to complete an impact assessment worksheet for each work group recommendation. The impact assessment worksheet was composed of two forms. The first form was used to describe, in detail, the primary direct and indirect impacts. The worksheet contained the following information: the resource or element to be impacted, the most probable conditions (2025) without the recommendation and the most probable conditions (2025) *with* the recommendation. The impact was measured by comparing the difference between the most probable future conditions without action to those conditions if the recommendation was implemented. *It should be noted that the preparation of impact assessments is based on the concept of the recommendation only. The agency responsible for implementation in their planning process will be required to do a further assessment of the potential impacts.*

The second form of the impact assessment worksheet contained 17 elements. Each work group was to analyze each of these elements and determine if a recommendation had:

- no direct impact
 - negligible direct impact
 - no direct impact, indirect impacts may need further assessment
 - significant direct impact
- on these elements.

The 17 elements were: noise, displacement of people, aesthetic values, community cohesion, (desired) community growth, tax revenues, property values, public facilities, public services, (desired) regional growth, employment/labor force, business/industrial activity, displacement of farms, man-made resources, natural resources, air quality, water quality/quantity.

If the work group recommendation was believed to have potential significant direct or indirect impacts on any of these elements, the impact was displayed in greater detail on the first form.

Each work group was responsible for obtaining or estimating the necessary information for their impact assessment through their studies, work group meetings, discussions with other work groups, discussions with other agencies having expertise in that particular field, discussions with economists and/or discussion with the impact assessment coordinator (provided by the RID/COE). In many cases preparation of the impact assessments was difficult to impossible due to lack of quality, factual data.

When the impact assessment for a recommendation was complete to the best of a work group's ability, the recommendation was ready for Stage 3 analysis.

STAGE 3

The emphasis in Stage 3 shifted from formulation of alternatives, selection of alternatives and general impact assessment of the selected alternatives to the synthesis and modification of the many work group recommendations into comprehensive, preliminary plans.

At this point, activities of the PFWG were focused simultaneously, into two major areas: 1) formulation of preliminary alternatives and, 2) evaluation of work group recommendations.

A special task force of the PFWG was developed in October, 1979. This Plan Formulation Report Evaluation and Preparation Task Force, PREP, was to aid the PFWG in the development of alternatives.

The actions of PREP served only as a guide to the PFWG and required PFWG approval where decisions were involved. (All criteria,

procedures, format and plans as developed by PREP, are explained in detail in the PFWG Appendix in Chapter IV.)

ALTERNATIVE DEVELOPMENT. As specified in Principles and Standards (P&S) one alternative plan will be formulated in the planning process, in which optimum contributions are made to promote National Economic Development (NED). Additionally, during the planning process at least one alternative plan will be formulated which emphasizes the contributions to promote Environmental Quality (EQ). Other alternative plans reflecting significant physical, technological, legal or public policy constraints or reflecting significant trade-offs between the NED and EQ plans may be formulated so as not to overlook a best overall plan. A precise number of alternative plans cannot be specified in advance but will be governed by the relevancy of the objectives to the planning setting, the extent of the component needs and their complementarity, the available alternatives and the overall resource capabilities of the area under study.

A true NED-EQ analysis and development of such plans is difficult to apply to a study of this complexity and scope. Procedures for the development of NED and EQ plans are most suited to a single purpose, action-oriented study. The GREAT II Study is a multi-purpose, action-oriented study, and although specific actions or plans will be recommended, the majority of the study does not lend itself to application of P & S procedures. The following represents the GREAT II PFWG's interpretation of how to apply P & S to GREAT II's plan formulation process.

PREP developed assumptions and criteria to aid the PFWG in the categorization of all work group recommendations into NED and/or EQ alternatives, prior to PFWG review, modification and/or approval. These are displayed below. Other criteria used in the NED and EQ alternative development are displayed in the PFWG Appendix, Chapter IV. The alternatives are displayed in the same chapter of the PFWG Appendix.

The NED alternatives include policies, plans or studies which could:

- **Criteria**—Increase the value of the nation's output of goods and services and improve national efficiency.

Assumes—That government expenditures will increase total national output (a Benefit/Cost Ratio of greater than 1.0).

Examples—Increase crop yields, expand recreational use, reduce flood damage, employ previously unemployed resources.

- **Criteria**—Reduce the cost of a present output.

Assumes—That government, private or resource expenditures can be reduced while still providing at least the same level of services.

Examples—Reduce access costs, reduce transportation costs, reduce or eliminate certain management costs, reduce energy costs.

The EQ alternatives include policies, plans or studies which could:

- **Criteria**—Create, conserve, or improve the quality of certain natural and cultural resources and ecological resources and ecological systems.

Assumes—EQ alternatives are usually characterized by their non-market, non-monetary nature.

Examples—Reduce or eliminate wetland impacts, protect cultural resource sites, improve water quality.

- **Criteria**—Enhance the quality of life.

Assumes—Same as above.

Examples—Improve natural beauty, preserve valuable archeological, historical, biological and geologic resources and ecological systems, enhance water, air and land quality, avoid irreversible commitments of resources to future uses.

RECOMMENDED PLAN DEVELOPMENT. Evaluation of work group recommendations occurred at monthly PFWG meetings by all work group chairmen present. The recommendations were evaluated on the basis of criteria which had been reestablished by each work group for their area of expertise. (Work group evaluation criteria are included in the description of the study process in the PFWG Appendix.)

A recommendation could receive an evaluation by work group chairman of a:

'+'—The recommendation benefitted a particular concern or resource and was therefore acceptable to the work group.

'-'—The recommendation was detrimental to a particular concern or resource and was therefore unacceptable to the work group.

'o'—The recommendation had no effect on a particular concern or resource and was therefore acceptable to the work group.

'c'—The recommendation would have an adverse impact to a particular concern or resource if certain conditions were not met and is only acceptable to the work group if so stated conditions are met.

The PFWG then voted to determine if the group as a whole: 1) approved of the evaluation, and 2) elected to include the recommendation in the 'recommended plan.'

The recommendations evaluated by the PFWG were categorized into the following four groups:

- Recommendations which presented no measurable conflicts to any work group's evaluation criteria. These recommendations became part of the 'draft' recommended plan.
- Recommendations that presented conflicts with some work group's evaluation criteria but were resolvable upon PFWG discussion of the recommendation; if 'certain' conditions were met. These 'certain' conditions were added to the recommendation, and the recommendation became part of the 'draft' recommended plan.
- Recommendations that presented conflicts which were unresolvable according to more than two work groups' evaluation criteria. These recommendations were considered rejected by the PFWG and did *not* become part of the 'draft' recommended plan.
- Recommendations that presented unresolvable conflicts to only one or two work groups. Although every attempt was made to arrive at consensus, there were cases where a recommendation was objectionable to only one or two work groups, and the PFWG voted to accept the recommendations as part of the 'draft' recommended plan. In these cases, the unresolved conflicts were added to any PFWG discussion of the recommendation.

The recommendations as evaluated and approved by the PFWG did not fully represent a 'plan.' The recommendations duplicated one another in some areas and were not specific enough in others. In order to aid the PFWG in developing a cohesive 'recommended' plan, the 'PREP' Task Force refined, reorganized and combined the recommendations.

Of the 166 original work group recommendations, 151 were approved by the PFWG for inclusion in the recommended plan. Through the process of combining similar and/or identical recommendations, the 151 recommendations were condensed into 64 action areas. Each of the 64 action areas was given a 'PREP' number to facilitate indexing.

The GREAT II Preliminary Feasibility Report defined river management and therefore a river management plan, as being composed of ten components. These ten components were identified as: commercial transportation, channel maintenance, commercial/industrial/utility, floodplain management, recreation, water quality, sediment and erosion, fish and wildlife, cultural and aesthetic and wild.

The cultural and aesthetic and wild components were combined, however, as the areas of concern that each addressed overlapped considerably. The new component was called "Cultural and Aesthetic."

The recommended plan as developed by the PFWG was organized into 9 components and was contained in the draft report. Three sections of the recommended plan, 1. Public Information and Education Program, 2. Ongoing Coordination and 3. Legislation, were developed in addition to the 9 components. These three additional sections provide guidance for implementation of the plan.

The team reviewed and analyzed the plan developed by the PFWG. Based on this analysis the Team modified, deleted and/or added recommendations to the plan. The final team approved plan contains 56 recommendations, and is displayed in Chapter 3.

Two charts have been prepared to show the

disposition of each of the work group recommendations. One chart precedes the recommended plan, the other is shown in Chapter 4 of the PFWG Appendix.

CHANNEL MAINTENANCE PLAN

DISPOSAL SITE SELECTION: One of the GREAT II objectives, in reference to the Channel Maintenance Component, was to produce an environmentally and economically acceptable Channel Maintenance and Operation Program. A special task force of the PFWG, the Disposal Site Selection Task Force (DSSTF), was established: to develop and implement procedures for selecting disposal sites and parameters for disposal at these sites, which would incorporate the concerns of all participating agencies. The DSSTF, although subject to the same regulations which guided the GREAT II process in general (i.e., P & S and ER's), developed by necessity, a more detailed process and therefore must be discussed as a separate process.

The disposal site selection process can be broken down into the following general stages:

- Map potential disposal sites.
- Review potential sites.
- Project dredging volumes.
- Review and select sites by DSSTF.
- Summarize dredged material disposal plans.
- Obtain cost and impact data.
- Re-evaluate disposal plan based on costs, impacts, and distance limitations.
- Resolve conflicts at the Team level.

Utilizing this process the Team developed and approved the GREAT II Channel Maintenance Plan (see Chapter III: Channel Maintenance Component and accompanying document "Channel Maintenance Handbook.").



PLAN-OF-STUDY

chapter **12345**



*"All problems become smaller if you don't
dodge them but confront them. Touch a
thistle timidly and it pricks you; grasp
it boldly, and its spines crumble"*

William S. Halsey

This chapter summarizes the results of Stages 1 and 2 of the GREAT II process. The area resources and the multiple uses and demands on these resources are discussed as they relate to the problems and needs identified and studied by the GREAT II Team. The chapter ends by summarizing, in tabular form, the problems, the studies, and the resultant recommendations.

AREA DESCRIPTION¹

WATER

The floodplain covers 868 square miles; of this, 269 square miles are water.

Of the UMR tributaries within the GREAT II reach, there are at least 44 creeks and 25 rivers. Nine of the rivers are considered 'major' tributaries (drainage greater than 1000 square miles). The largest of these are the Des Moines and the Rock Rivers. The tributaries within the GREAT II reach of the UMR contribute 26,110 cubic feet per second (cfs) of flow to the mean daily flow. (Mean daily flow is 68,510 cfs at Lock and Dam 22).

The drainage area of the UMR ranges from 79,200 square miles at Lock and Dam 10 to 137,606 square miles at Lock and Dam 22. Elevation of the river at flat pool at Lock and Dam 10 is 603 feet. The elevation drops an average of 11.9 feet per pool to a low of 459.5 feet at Lock and Dam 22.

LAND

The topography of the uplands in the northern third and the southern third of the GREAT II area is hilly with local relief variations of up to 200 feet. The middle third is rolling uplands with local relief variations of up to 100 feet.

Along the river corridor, dissection has cut deeply into glacial deposits creating steep-walled, gorge-like ravines. From Dubuque, Iowa to the southern tip of GREAT II the UMR has broken topography with high bluffs in combination with generally wide and flat floodplains that are used mainly for agricultural purposes. The major wetland areas are concentrated in the river bottomlands.

Predominant soils of the northern GREAT II area are dark colored, developed mainly under prairie vegetation. Soils vary from well-drained, sandy bottomland soils in the floodplain to loess, and in some cases glacial till on the uplands. In the southern GREAT II area light colored soils develop under forest vegetation on the uplands and are generally poorly to moderately well-drained.

¹More specific area/pool descriptions are presented in the PFWG appendix.



Flood control levees line the river bank and allow extensive agricultural use of old floodplain lands.



The river valley is a rich environmental and economic resource serving a variety of uses and users.

LAND OWNERSHIP

Table IV displays in general terms the land ownership patterns along the GREAT II reach of the UMR. There are a total of 2,733.5 miles of shoreline (includes mainland and island) in and along Pools 11 through 22. Acreage figures have not been determined for lands adjacent to the river (with the exception of lands above flat pool within the river—i.e., islands) as there is no boundary established as to where the pool limits end on land. There are

a total of 32,976.5 acres of island contained within Pools 11 through 22. Of these 28,662 are Federally owned. The COE controls most of the Federally-owned shoreline in the GREAT II reach. The shoreline miles controlled by the COE represent those lands acquired in connection with the 9-foot channel navigation project. Of the lands controlled by the COE, certain lands have been turned over to the USFWS and states under cooperative agreement, for management of fish and wildlife resources.

TABLE IV

POOL NUMBER	TOTAL MILES OF SHORELINE	FEDERALLY OWNED SHORELINE	NON-FEDERAL SHORELINE	TOTAL ISLAND ACRES	FEDERALLY OWNED ISLANDS	NON-FEDERAL ISLANDS
11	312.0	275.0	37.0	3,976	3,858	118.0
12	280.0	240.0	40.0	3,674	3,419	255.0
13	503.0	476.0	27.0	5,667	5,527	140.0
14	277.0	189.0	88.0	3,167	2,545	622.0
15	38.0	8.0	30.0	1,347.5	1,000	347.5
16	231.0	200.0	31.0	—	N A	N A
17	202.5	178.2	24.3	3,008	2,816	192.0
18	279.0	249.0	30.0	4,387	4,337	50.0
19	246.0	1	246.0	—	0	All
20	93.0	5.2	87.8	1,943	0	1,943.0
21	146.0	121.0	25.0	5,807	5,160	647.0
22	126.0	113.0	13.0	—	N A	—
22	126.0	113.0	13.0	—	N A	—
TOTAL	2,733.5	2,054.5*<!--</b-->		32,976,662*<!--</b-->	28,662*	4,314.5*

*Total miles of shoreline equals all shoreline footage (includes mainland and islands) at flat pool.

*Federally owned means those lands acquired by the Federal government and includes lands administered by the COE, USFWS, Savanna Army Depot, etc.

*Non-federal includes those lands under state, local or private ownership.

*The only Federal land in Pool 19 is 2.88 acres acquired by the COE for construction of Lock and Dam 19.

*Same as 6 & 7.

*This figure is low as the island acreages for Pools 16 and 22 were not available.

*Same as 6. In addition, island acreages were not available for Pool 19. However all islands in Pool 19 are owned by non Federal entities.

POPULATION

The overall population of the study area is expected to steadily increase through the year 2025. A total of 51 of the counties studied by the Recreation Work Group (RWG) will gain population while 15 are expected to lose population.

The Quad Cities area is expected to remain the major metropolitan center in the study area and will probably show a substantial increase in population by the year 2025. Taken as a whole, the study area is projected to grow at a faster rate than the United States with an overall increase of 27% compared to 18%. The area share of United States population will grow from 13% to 14%. This share represents over 250,000 people.

The basic composition of the total population study is not expected to vary greatly. In each of the states it is expected that future populations will have greater percentages of people age 15-65 and 65 and above. The percentages of people age 0-14 are projected to decrease. (COE population projection report).

RESOURCE USES, CONDITIONS AND PROBLEMS

COMMERCIAL TRANSPORTATION

Commercial transportation on the Upper Mississippi can best be understood as a component of a broad national and regional transportation network composed of five principal modes: motor carrier, railroad,

pipeline, airline and waterway. These modes interact in a complex manner, competing for cargo or complementing each other's services depending upon the type of cargo or service area of each mode.

Highways serve as vital links to commerce throughout the nation with some 40,000 miles of interstate highway criss-crossing the country and nearly 3 million miles of surfaced roads. The GREAT II area is served by two interstate highways, I-80 and I-74. The railroad is the next most extensive transportation network. There are approximately 190,000 miles of railroad lines in the United States. Five railroads have routes parallel to the UMR within the GREAT II area. These railroads also provide connecting service to communities on both sides of the river.

Air transportation is available to larger airports (St. Louis, Chicago, Minneapolis/St. Paul) which connect with most geographic areas of the nation.

Pipelines serve regions of the country with highly developed resources and demands. Pipelines are a practical low-cost means of transporting liquids and pressurized gases. There are 31 submarine gas and oil lines crossing the Mississippi River in the GREAT II area.

In contrast to the land based modes of pipeline, air, rail and truck which are distributed across the entire breadth of the country, the 25,543 miles of usable navigable inland channels are found principally in the eastern one-half of the United States. Like the Mississippi River System, inland water routes have primarily followed natural watercourses.



Rail lines run adjacent to the river and provide another important mode of commodity transport.



In 1979, twenty-nine million tons of cargo were transported into, out of, or through the GREAT II area.

Inland waterway navigation is an advantageous form of transportation for bulk commodities because of its low cost to the shippers. Although many factors are considered when determining transportation costs, the major factor attributing to the relatively low cost of navigation is the low amount of energy required for barge movements.

The Mississippi River System is a key section in the nation's commercial waterway. Along with the Upper Mississippi, this system includes the Lower Mississippi, Illinois River, Ohio River and tributaries, Missouri River, the Ouachita River and tributaries and the Gulf Intracoastal Waterway.

The Upper Mississippi River extends from Cairo, Illinois to the head of navigation in Minneapolis, Minnesota. Between the Missouri River and Minneapolis, the river has been improved for navigation by a system of 29 locks and dams. These locks and dams have changed the river into a series of "steps."



The lock and dam system regulates flows to provide a 9 foot navigation channel.



Commodities transported include grain, coal, oil, and petroleum products.

River tows and other boats either "climb" or "descend" as they travel upstream or downstream.

Before any navigation improvements were made, the Upper Mississippi was uncontrollable and treacherous for navigation. Spring flooding uprooted hundreds of trees and carried them into the river, forming snags that were a hazard to any vessel traveling on the river. Rapids were also serious obstacles to navigation. The creation of pooled areas and other navigational improvements has reduced snags and eliminated rapids.

The present navigation system was initiated in 1930, when Congress passed the River and Harbor Act authorizing funds for its development. This legislation was interpreted by the COE that they were to provide for a navigation channel that would accommodate 9-foot draft vessels and was a minimum of 300 feet wide. This channel was to be established by construction of a series of locks and dams to work in conjunction with regulatory structures and augmented by dredging.

From 1946 to 1974 the COE practiced overdepth dredging and dredged to 13 feet in some areas. Various agencies and interest groups have taken issue with the COE interpretation of this legislation. Many believe that the intent of Congress was to provide for a channel that was nine feet deep. However, commercial interests feel that it was clearly the intent of Congress to provide a channel with sufficient depth for a 9 foot draft vessel. This controversy can only be resolved by litigation or Congressional action. The GREATH Team discussed this issue but could not reach consensus as to a recommended definition of the 9 foot channel.

Water transportation developed to meet the needs of industry and because it provided a lower shipping cost than was attainable from other modes. Barge traffic through the GREATH area (RID COE lock records) in 1979 showed over 29 million tons of cargo transported into, out of, or through the GREATH area. The average barge capacity is approximately 1,500 tons, 52,000 bushels or 453,000 gallons when loaded to a 9-foot draft. Tows consist of one or more barges up to a maximum of 15 barges in the pooled portions, while tows of 35-45 barges are not uncommon in the open river. According to barge forecast studies in GREATH, an annual compounded growth rate of 3.69% is expected, which could result in a doubling of tonnage shipped by the year 2001. The

navigation channel is maintained primarily by control structures such as wing dams and closing dams and by the gated pool dams. Were it not for stage fluctuations in both the main channel and tributaries these measures would probably insure an adequate channel. Since precipitation and rainfall are irregular, however, it is frequently necessary to remove sand from the main channel because of imbalances in the rivers sediment transport capability.

Insufficient channel widths and depths can cause delays to barges which costs the industry, and indirectly the consumers, money.

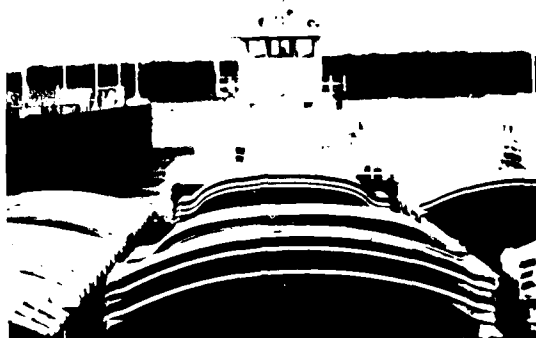
While the locks themselves were created for navigation on the one hand, they are an obstacle to navigation on the other. A 15 barge tow must break its tow in half in order to get through the 600 foot locks. The average time to perform a lockage of this type is 1½ hours. Safety problems occur when both recreational crafts and barges are waiting for passage through the locks.

Drawbridges (moveable—i.e., swing or lift bridges) cause delays and hazardous conditions for barges. Accidents involving these type of bridges also affect rail and highway traffic as well as barge traffic. Studies have shown that most barge-bridge collisions can be avoided through proper bridge designs which take into account the needs of commercial navigation, river hydraulics and flow patterns. Other problems for barges result from inadequate mooring procedures/facilities for barge fleeting areas in the GREAT II area. Lengthy and time-consuming permitting procedures have caused expensive delays in the development of these facilities. A plan for terminal development in the GREAT II area is needed.



CHANNEL MAINTENANCE

Historically, each spring, as soon as river conditions permit, biweekly trips are made by river channel inspectors with electronic sounding equipment to check the channel's condition. The inspectors' reports are submitted to the Rock Island District's Operations Division where they are reviewed to identify problem areas. These problem areas are then scheduled for detailed hydrographic surveys. On the basis of the detailed surveys, the Operations Division determines areas that need to be dredged. The General Engineering Section, Rock Island District, checks each



One of the identified constraints to commercial navigation is the lock system.



Other constraints include drawbridges and lift bridges which impede traffic flow.

location and estimates the quantities that will be dredged and maintains the dredging records. Before the actual dredging begins, Rock Island District conducts conferences to discuss the potential dredge and disposal sites.

Beginning in the late 1960's, annual meetings were held by the RID/COE to provide personnel from natural resource agencies an opportunity to comment on dredging proposed for the upcoming year. With the advent of the Great River Studies an On-Site Inspection Team (OSIT) was developed to more effectively deal with site-specified dredged material problems. The intent was greater coordination of input from river



Average dredging volumes for the last 39 years exceeds 1 million cubic yards annually.

biologists into the Corps of Engineer's dredged material disposal decisions. In GREAT II, the OSIT evolved one step further, such that the OSIT now consisted of the GREAT II work group chairmen. The intent being greater coordination of input of all interest groups into the Corps of Engineers dredged material disposal decisions.

The channel maintenance activities of the UMR focus on dredging and consequent disposal of the dredged material. A portion of the dredging requirements may be caused by sedimentation. Therefore the three main problem areas with reference to channel maintenance are:

1. Sedimentation
2. Dredging requirements
3. Dredged material disposal impacts.



Main Stem and tributary streambank erosion contributes sediment to the Main Channel of the Mississippi River.



Material dredged from the river must in turn be placed in a disposal area.

SEDIMENTATION. Sediment carried by tributary streams causes shoaling in the navigation channel of the Mississippi River Main Stem when the maximum tributary supply is not synchronous with main channel transport capability. Dredging and disposal of material is then required to maintain channel operation.

DREDGING REQUIREMENTS. Upland and streambank erosion account for a major portion of the sedimentation problems. Dredging requirements, however, are affected by other factors which influence the amount of material dredged in a given location; such as channel width and depth and the velocity and volume of water passing a point in a given time (flow). Due to the influence of these hydraulic factors, even optimum control of upland erosion would not alleviate the dredging requirements. A river system undergoes constant change, scouring and depositing continuously. Certain portions of the river are more prone to deposition of sediment than others (i.e., dependent upon flow velocity, current patterns, etc.). Most pools in the Rock Island District have a number of chronic (recurrent or recent) dredging areas. (See PFWG Appendix—Pool Base Conditions for specific listings.)

Dredging in The Rock Island District has steadily decreased in quantities dredged since the locks and dams were put into operation in the 1940's. The reasons for this steady reduction in dredging quantities have been both natural and man-made.

Immediately after the locks and dams were put into operation, the Mississippi River underwent changes in its water surface profile during low flows. Before 1940 the river was a free-flowing alluvial river within the constraints of the 6-foot channel training structures. With the placement of the locks and dams, it became a stepped gradient river. The river bottom was not characteristic of a step-type gradient and, thus, has gradually tried to readjust itself, its bottom profile, sediment transport characteristics, and main channel location. Large quantities of material were dredged during this period to maintain a navigable channel. This is because the new channel did not follow the old meandering channel. (see Table V)

TABLE V

	AVERAGE VOLUME DREDGED (cubic yards)	AVERAGE ANNUAL FLOW (cubic ft/sec)
Past 39 years	1,102,000	65,400
Past 20 years	989,260	70,200
Past 10 years	761,970	74,600
Past 5 years	231,270	65,600
Past 3 years	121,000	66,200

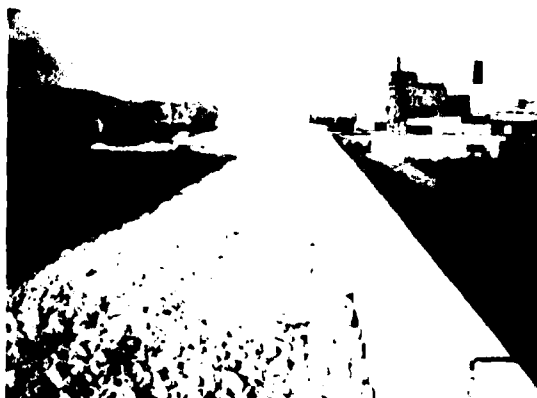
After several years of attempting to stabilize the river system from the time the dams were built, the river bottom is somewhat stabilized and does not meander as an uncontrollable river would. Consequently, dredging quantities also began to stabilize and were mainly a product of the hydrologic cycle. Dredging quantities have also been reduced in the past five years due to in-house changes in RID/COE survey and dredging procedures and recommended changes by the GREAT II OSIT Team.

Problems in maintaining the navigation channel, based on experience and analysis of past dredging operations, indicate that regardless of how large a channel may be dredged, the characteristics of the river will only support an open channel with a specific size depending on the hydraulic conditions in the channel. For the Mississippi River, within the Rock Island District, this channel generally falls in a range between 200 and 800 feet. Dredging which is done excessively beyond this range is usually ineffective, since these areas will refill at a rapid rate, then stabilize at the width that the channel can support (based on the flow of the water in that area).

Current channel widths are maintained up to approximately 600 feet by Engineering Technical Letter 1110-2-225 on river bends, and a minimum of 300 feet in areas with little or no directional change. Depth of dredging is currently done to 11 feet, unless site specifics indicate a need for a dredge depth of more than 11 feet (see discussion on page 20). This determination is made after a fluvial hydrologist conducts a detailed study of the site, specific problems, and possible alternatives. These recommendations are based on river hydraulics only, and do not take into account the effects of channel depth.

In some areas of the river, the width and depth of natural supportable channel is less than that required for navigation. This is sometimes due to a reduction in flow in an area. A reduction of flow in the main channel may occur when a large portion of the flow naturally directs itself out of the main channel and into off-channel areas. Closing dams constructed at the point of diversion direct the flow of water back to the main channel. Other channel control structures, such as wing dams, were constructed to produce a faster current as well as directing the flow regime in the main channel, with the intent of reducing the need for dredging. Also, banks along the channel have been protected with revetment, where necessary, to maintain channel position.

Continuous adjustments and repairs to the above-mentioned channel control structures are necessary to maintain their hydraulic effectiveness. Refer to pool maps in the DRWG Appendix for the location of wing dams, closing dams, and bank protection work in the GREAT II area.



Banks along the channel have been protected, where necessary to maintain channel position.

DREDGED MATERIAL DISPOSAL. The most obvious way to reduce disposal impacts is to reduce dredging volumes through reduction of sedimentation and dredging requirements. However, this cannot be totally accomplished due to hydraulic fluctuations in the river system as previously stated. There will most likely always be a need for some channel maintenance dredging, and therefore always a potential for dredged material disposal impacts.

All material dredged from the river must have a disposal site, be it land and/or water. Although the size of the disposal site is primarily dependent upon the amount of material dredged, other factors play an important part and must be considered. The length of time the material will remain on the site is a factor in determining the size of the disposal site needed. Thus a smaller site can be used if the material is periodically removed.

Where and how the dredged material is placed can influence the potential for impacts of dredged material disposal on water quality, fish and wildlife habitat, side channel conditions, flood levels, cultural resources and recreation.



Dredged material disposal adjacent to the Main Channel has resulted in the creation of recreational beaches . . .

Dredged material has historically been used for various purposes in the Rock Island District. Due to equipment and transport capability limitations most dredged material has been deposited in such a manner as to create beaches either on islands or the banks of the river. In most cases the material is accessible only by boat. Historically the demand for dredged material was relatively low and those demands were hard to satisfy for the

following reasons:

- the lack of public knowledge of the characteristics, availability, and uses of dredged material
- the inability of the COE to predict when and where dredging will occur
- COE policy restricting placement of dredged material.

One of the largest single reasons GREAT was organized was because of the opposition of various agencies and states to disposal sites and dredging methods used by the Corps of Engineers. Critics of the Corps of Engineers disposal methods have shown that the dredged material has been placed in areas where the material erodes back into the main stream rapidly and can potentially destroy aquatic habitat and mussel beds. Others have shown that the actual placement of dredged material in certain areas is destroying valuable wildlife habitat. Many people have claimed that any disposal of the dredged material in the floodplain not only adversely impacts the fish and wildlife resources and water quality, but also affects flood heights and consequently annual flood damages.



But it has also resulted in destruction of fish and wildlife habitat.

Corps of Engineers dredging equipment available to the Rock Island District is inadequate to meet all environmental conditions. The flexibility of the COE to change the type of equipment used or the methods used in dredging is somewhat restricted due to the legislative actions of the early 1970's. Those actions placed a moratorium on the purchase of additional dredges and dredging equipment.

Other problems which have prevented widespread beneficial use of dredged material are the lack of knowledge by the potential users of the availability of the material and the lack of knowledge of the structural characteristics of dredged material.



COMMERCIAL/ INDUSTRIAL / UTILITY

Industrial development and community growth are dependent upon one another. Industry develops in those communities which offer those characteristics essential to their growth. Communities promote development of industries which will enhance their growth. Factors influencing the desirability of a particular community or location to an industry include, but are not limited to, the following:

- Availability and cost of land
- Availability and cost of labor
- Availability and cost of raw materials
- Availability and cost of project financing
- Service, reliability and cost of utilities
- Amount of taxes
- Proximity to end markets
- Availability, service and cost of transportation

The cost of transportation greatly influences the location of certain industries which depend upon major shipments of materials. Industries located along the UMR have done so to take advantage of the relatively low costs of barge transportation and the convenient availability of intermodal types of transportation.



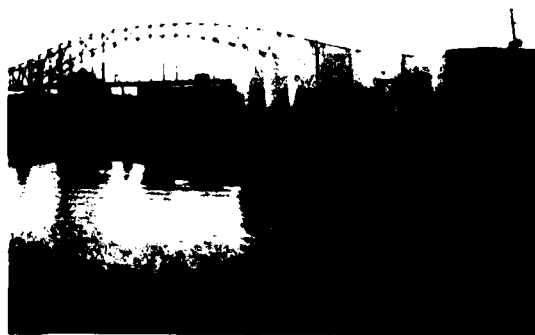
Grain terminals are dependent upon access to the waterborne mode of transport . . .

Four industries in the GREAT II area are primarily dependent upon inland navigation. These are:

- **Agricultural Products**—corn, soybeans and other grains—corn gluten feed pellets, soybean meal and other grain products.
- **Fertilizer**—both phosphate and nitrogen-based fertilizers
- **Energy**—petroleum and petroleum products (gasoline and diesel fuel).
- **Coal**—utilities are the principal end users of coal

Constraints affecting costs to barge transportation have already been discussed. However, it can be seen that increases in costs of transportation adversely affects those industries dependent upon that form of transportation. Transportation costs are only one aspect of the problems affecting industrial development and growth. A number of problems related to economic development in the GREAT II area were identified. The most important of these were:

- **The Lack of Adequate Truck and Rail Transportation.** Access to both rail and truck transportation is essential to those industries located along the river. Industries are concerned that a curtailment of rail service (i.e., rail abandonments) in the GREAT II area due to increased rail abandonments would adversely affect existing barge traffic and limit the potential for expansion.
- **The Lack of Good Industrial Sites Along the River.** Limited amount of land remains available for large scale industrial



As are industries manufacturing other commodities, such as agricultural products.

development in the Quad Cities area. Land availability was not considered for other areas. The number of sites that meet a company's requirements is very limited and the process of identifying these attractive sites can be a costly one. Regional planning commissions could provide helpful input in the identification of suitable development sites.

- **The Lack of Fleeting Spaces.** A shortage of fleeting areas¹ can cause increases in operating costs for towing firms, shippers and fleeting operators, and inhibits the development of river port activity. Resistance to establishing fleeting areas usually centers around the following issues:
 - Proposed site may be a fishing area
 - Fleeting area would mar scenic vistas
 - Public would lose access to shoreline
 - Increased barge activity would cause more pollution and congestion.
- **The Lengthy Review Process for Approving Industrial Development Projects.** Initially, a company's decision to locate in a certain area depends, to a degree, on the local environment for commercial development. Commercial concerns have indicated that their experience with the costs and lengthy delays associated with the current review process suggests that river development is a risky venture. In addition, the bureaucracy surrounding commercial development of the UMR has created misunderstandings between the business community and the various agencies.

A number of other factors important for economic development were not included in this consideration. These factors include taxes, labor, utilities, financing, flood protection, river level fluctuation and siltation.

FLOODPLAIN DEVELOPMENT

All counties that border the Mississippi River are affected in varying degrees by widespread, frequent, and sometimes severe flooding associated with the main stem and its tributaries.

¹According to studies conducted by the CWRG, there are presently adequate fleeting areas within the GRE-AT-H area, with the exception of pools 16, 17 and 19. Terminal activity in these three pools may be constrained in the future due to a lack of fleeting sites.

Fleeting operators in these pools may be forced to use sites that are further from their customers.

In urban areas, residential property is damaged or destroyed, commercial and manufacturing activity and production are interrupted, major transportation systems are shut down, and recreational lands and facilities deteriorated. The extensive damages incurred by river communities have been due to the failure of the urban areas to restrict floodplain development to those uses compatible with the risk.

In rural areas, flooding ruins crops, dwellings, equipment, and machinery. Recreational lands and facilities, scenic areas, and soils are damaged. Prolonged periods of high water also contribute to septic tank malfunctions, breakdown of drainage systems, and internal drainage problems.



But access to the river sometimes means the river has access to you!



Living along the river can mean that you are subject to nature's ways... flooding is a common event on the river.

The continued conversion of natural floodplain lands to agricultural uses as a result of levee construction will increase the potential for damages caused by flooding. The flood waters which would normally be distributed across the floodplain will be confined to the channel, increasing velocities downstream and raising flood stages upstream. (FPMWG appendix).

The changes made to the Mississippi River for navigational purposes may be affecting stage-discharge relationships. The combination of locks and dams, navigation works, and the placement of dredged material in the floodplain reduces the storage capacity and conveyance, thereby raising flood heights. The cumulative impacts of these changes have not yet been determined.

Flood damage estimates reflect several categories of damage, including those which affect urban and built-up areas, crops, rural property, rural utilities, roads and railways, forest and grasslands, refuges, etc. Based upon 1966 dollars and conditions, the Upper Mississippi River Comprehensive Basin Study projected average annual downstream flood

damages for the GREAT II area to be approximately \$8 million in 1980. This estimate was based on the assumptions that existing flood protection would remain the same and that the flood risk would remain unchanged.

Loss of wages, temporary housing, evacuation expenses, and increased expenditures by municipalities for emergency flood protection and additional fire and police service are additional costs caused by flooding.

In spite of the flood protection programs of the past 30 years, the average annual flood damages increase as use of the land resource intensifies in flood prone areas. The general growth of population, income, and wealth, the increasing demand for land, and the ease of construction in the floodplain, are the primary factors causing increased floodplain development.

Table VI shows a breakdown of the types of land use which have developed within the floodplain. Major urban areas which are subject to flooding are listed. There are a total of 361,554 acres of land within the floodplain in the GREAT II area. Approximately 85 percent or 306,545 acres of this land is used for agricultural purposes.

**TABLE VI
FLOOD PLAIN LAND USE
MISSISSIPPI RIVER MAIN STEM—GREAT II REACH**

POOL NO.	MILEAGE	TOTAL	ACRES		URBAN AREAS SUBJECT TO FLOODING
			CROPS AND PASTURE	OTHER	
22	301-325	89,946	68,258	21,688	Hannibal, Missouri
21	325-343	28,954	26,649	2,305	Quincy, Illinois; Canton and LaGrange, Missouri
20	343-364	57,523	50,380	7,143	Keokuk, Iowa
19	364-410	34,242	30,472	3,770	Burlington, Fort Madison, Iowa; Dallas City, Pontoosuc, Niota, Illinois
18	410-437	48,776	45,770	3,006	New Boston, Keithsburg and Oquawka, Illinois
17	437-457	65,799	56,494	9,305	Muscatine, Iowa
16	457-483	1,895	1,665	230	Rock Island and Andalusia, Illinois; Buffalo and Linwood, Iowa; part of Davenport, Iowa
15	483-493	255	200	25	Hampton, Moline and East Moline, Illinois; Bettendorf, Iowa and part of Davenport, Iowa
14	493-522	17,369	12,196	5,173	LeClaire, Princeton, Camanche and Clinton, Iowa; Fulton, East Clinton, Rapids City, Cordova and Albany, Illinois
13	522-557	12,425	10,791	1,634	Bellevue and Sabula, Iowa; Savanna, Illinois
12	557-583	430	220	210	Dubuque, Iowa; East Dubuque, Illinois
11	583-614	3,970	3,450	520	Cassville, Wisconsin
AREA TOTAL		361,554	306,545	55,009	

Source: Upper Mississippi River Comprehensive Basin Study, Volume 5, Table I-108, p. I-166, 1972.

The two basic strategies for achieving flood loss reduction are through the use of structural and nonstructural measures. Structural measures include construction of dams, dikes, levees, and floodwalls; channel alterations; high flow diversions and spillways; and land treatment measures. These programs involve large capital investments provided largely by the Federal government while the costs of maintaining and operating flood control structures usually fall on local governments. These structural programs are primarily the responsibility of the U.S. Army Corps of Engineers and the Soil Conservation Service of the Department of Agriculture.

Executive Order 11296, 11 August 1966 and Executive Order 11988, 24 May 1977 were signed by the President of the United States to promote floodplain management and to reduce flood damages. These Executive Orders stated that the leasing of lands within the floodplain for construction and maintenance of habitable structures is contradictory to the National Program for Managing Flood Losses. The



The levee system protects some 300,000 acres of agricultural land in the river floodplain.



Flood control depends, in part, upon construction of dams in the river's tributaries.

orders further emphasize the requirement that Federal agencies manage government-owned lands to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.

These orders have resulted in a policy for termination of private leases on all government lands within the floodplain including but not limited to the floodplain of the Mississippi River. Many private lease-holders have taken exception to these Executive Orders and the resultant policies. However, the termination of private leases has been advocated to provide for proper management of the floodplain and to ensure maximum use of Government land for general public purposes such as: conservation and management of fish and wildlife resources, conservation and management of forestry resources, recreation, and the preservation of natural and scenic areas.

Government owned lands are rapidly becoming the only undeveloped natural areas along the river. In the future there will be increasing pressure on Federal Agencies to preserve these areas in an undeveloped state.

Nonstructural measures are highly varied. They include floodplain land use regulations, land acquisition, development policies, floodproofing and flood insurance.

While structural measures and management activities have had short-term success in reducing flood damages, continued development in flood hazard areas and the escalating average annual flood damages indicate the inadequacy in the long term of the existing programs and projects for reduction of flood losses.

RECREATION

The 12 pools (314 miles) of the GREAT II reach of the Mississippi River provide excellent opportunities for outdoor recreation enjoyment. The 9-Foot Channel Environmental Impact Statement prepared by RHD COE, identified over 164,500 acres of water, 2,600 miles of shoreline (including islands) and 81,400 acres of publicly-owned lands in Pools II through 22.

The 1977 GREAT II Recreation Facility Inventory shows a total of 15,448 acres of undeveloped and 3,879 acres of developed recreation land, not including dredged

material beaches within the study area. In addition, there are approximately 255 boat launching lanes with over 5,145 adjacent parking spaces; 3,600 marina slips, and 3,200 private boats not in marinas. There are 3,200 individual camping units; 3,500 picnic tables; 50 miles of designated hiking trails; 10 miles of designated horseback riding trails; 5 miles of designated cross-country ski trails; and 20 miles of designated snowmobile trails. These facilities are provided by federal, state and local governmental agencies and commercial and private interests.

Additional recreational opportunities in the GREAT II area are fishing, hunting, trapping, bird-watching, and photography. Detailed economic benefits of these recreational activities have not been completed for the GREAT II area. However, figures developed by the GREAT II FWMWG show that fishing, hunting and trapping are of significant economic value (see discussion in Fish and Wildlife Component).

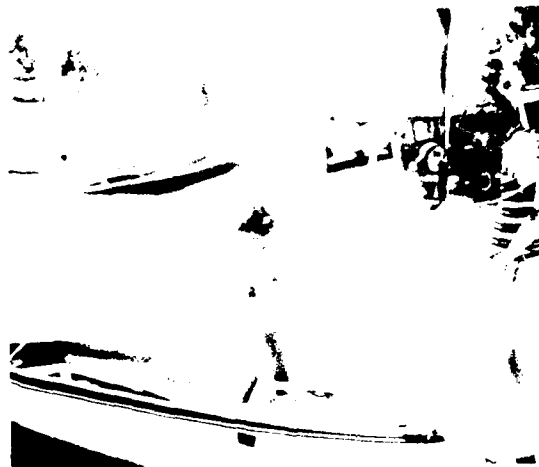
Recreation use information is compiled on a yearly basis for Pools 11 through 22 by the Rock Island District, Corps of Engineers under the Recreation Resource Management System (RRMS). The Recreation Work Group assessed recent changes and improvements in the RRMS and utilized an average of 1977 and 1978 information to develop "Base Year" data. The following table represents recreation use in activity days for the GREAT II area:²

GREAT II AREA	TOTAL ACTIVITY DAYS
Pool 11	1,204,350 Activity Days
Pool 12	1,234,400 Activity Days
Pool 13	1,346,701 Activity Days
Pool 14	1,573,050 Activity Days
Pool 15	1,306,000 Activity Days
Pool 16	1,873,700 Activity Days
Pool 17	905,450 Activity Days
Pool 18	1,207,750 Activity Days
Pool 19	2,322,200 Activity Days
Pool 20	270,800 Activity Days
Pool 21	2,330,850 Activity Days
Pool 22	1,566,900 Activity Days

BASE YEAR TOTAL 16,345,151 ACTIVITY DAYS²

An activity day is defined as "The attendance of one person at the area for the purpose of engaging in one or more recreational activities for one day or a fraction thereof. An activity day does not refer to a specific number of hours and should not be confused with visitor days." Activities include, but are not limited to, picnicking, camping, swimming, water skiing, boating, fishing and hunting. The RWG Appendix has shown the percentage of these activities in activity days for Pools 11-22.

Data could be used only for comparison purposes. See RWG Appendix.



There are 164,500 acres of water available for recreational use in the GREAT II area.



The river's edge is a favorite place for a campfire and a picnic lunch.



The river corridor is a popular place for hiking—enjoying the river does not always mean being "on" the river.

Presently there are recreation and recreation access facilities owned, operated and maintained by private entities and a cross-section of public agencies. A small portion of the facilities are owned in fee title and operated and maintained by private interests. Additional private facilities are operated and maintained under lease agreement with the Corps of Engineer, U.S. Fish and Wildlife Service, states or cities. This category includes 634 cabin site lease properties. The Corps of Engineers operate and maintain 26 recreation sites with a staff of seven permanent rangers.

The U.S. Fish and Wildlife Service operates portions the Upper Mississippi River Wild Life and Fish Refuge and the Mark Twain National Wildlife Refuge. Portions of these refuges are in the GREAT II area. Although these refuges were established for fish and wildlife management purposes they also provide recreational opportunities (i.e., hiking, bird-watching, photography, hunting, fishing and trapping).

Illinois, Iowa, Missouri and Wisconsin each own and lease recreation areas. This also holds true for many counties and cities along the river.

Funding for acquisition, development, operation and maintenance is derived from many sources ranging from line items in budgets, to general operation and maintenance funds, Marine Fuel Tax Funds, license and registration money, user fees, Land and Water Conservation Fund and Public Law 89-72 monies, private contributions of time, etc.

If all dredged material were to be removed from the floodplain it could pose serious problems to some types of recreation. Many beaches in the GREAT II area are a result of channel maintenance activities by the Corps of Engineers. Since no agency, public or private, has overall authority or funding for maintaining recreation beach areas, one can only assume that many of the existing beaches would deteriorate in the future.

Dredged material beaches have historically received large amounts of recreation use within the Mississippi River corridor. It has been noted by Corps of Engineers personnel that within hours after dredging operations cease, people utilize these beaches for recreation. Dredged material beaches provide primitive types of recreation with only make-shift facilities that individual recreationists may improvise. If such areas are to remain as future dredged material disposal sites, development of recreation facilities would complicate disposal practices and increase costs.

Conflicts also exist in relation to the navigation project and commercial navigation use. Portions of the pools created have very shallow areas and stump fields. While these areas provide good fish nursery and waterfowl areas, they are hazards to the boater unfamiliar with the river. Channel structures, such as wing dikes and closing dams, utilized to help maintain the navigation channel are also a hazard to the novice or inexperienced boater on the Mississippi.



Beaches created by dredge material are popular for swimming, socializing, and . . .



Camping with friends and relatives.

The establishment and existence of outdoor recreational facilities can have an effect on various facets of the environment. These effects can be of a positive or negative manner depending on the management, design, and use of the recreational areas. Through proper planning and design many of the negative impacts associated with the establishment of recreational facilities can be alleviated or reduced. Choosing a site for development with the proper carrying capacity in regard to the desired recreational activities can eliminate numerous negative impacts on the site's natural resources.

In the mid 1960's and continuing through the 1970's, society became increasingly aware of the benefits of outdoor recreation. This can be attributed to an increase in leisure time and personal disposable income. As time goes on, there will be increased competition for land and water resources for all types of uses. Every year more land is developed for residential and commercial use. In the future, the only land that may be available for certain recreational activities is government land. It is highly possible that these same lands will be needed for wildlife, forest products, aesthetics, buffer zones, as well as other zones. If the land is managed under the multiple use concept, all of these needs can be accommodated to a certain degree. In order to provide data to facilitate multiple use management, more guidelines on the types and location of recreational facilities will need to be established.

Having more accurate data on recreational use patterns and the incidence of hunting, trapping and fishing as the primary purpose of the visit is very important to recreational planning and natural resource aspects. Hunting, trapping and fishing require productive, healthy, undiminished environments to sustain populations and produce a harvestable surplus. If hunting, trapping and fishing are shown to be the primary recreational uses on the river, the justification for nourishing beaches to create and support the power boating and camping recreation visits becomes substantially diminished.

High density use recreation areas (beaches, picnic areas, etc.) should be developed in areas where habitat quality is marginal and impacts will be small, where alteration of the aesthetics will be minimal, and where centers of population will have easy access to the area.



WATER QUALITY

The water quality of the Mississippi reflects its geological, climatological and more recently its agricultural and industrial heritage. Despite urbanization, intensive agriculture and a thriving waterbourne commerce, water quality on much of the river has generally been good. Major reasons for the overall good quality of the river water are the large size of the river, hence its large waste dilution and assimilation capacity, and state and federal water clean-up programs.

The river is not without water quality problems. Some problems are common to most or all of the river. The most serious are believed to be localized problems below particularly large pollutant sources. These problems should diminish due to dilution, chemical processes, biological renovation or assimilation. Such health hazards as bacterial contamination, high metals content and a high content of chlorinated hydrocarbons (PCB's, pesticides) in fish occur in certain segments of the river.

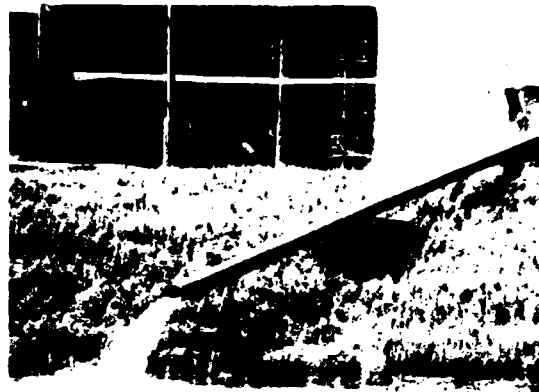
Iron, manganese and mercury frequently are in violation of water quality standards throughout the length of the river. The iron and manganese standards are aesthetic (taste, odor and staining) rather than health standards and much of the iron and manganese found in the water is the result of natural weathering. The mercury standard is violated frequently because the allowable amount of mercury in water is very close to the amount of mercury naturally occurring in the water. Therefore, weathering and soil erosion may also account for the extensiveness of the mercury problem.



Violations of water quality standards are generally localized—most frequent in heavily industrialized urban areas.



Toxic substances such as Dieldrin, an insecticide used in the agricultural industry, are a threat to aquatic life in the river.



Point-source pollution is a major threat to the river's water quality.

Several pesticides toxic to aquatic life have been found in the water and in fish in the UMR, Dieldrin being of most concern. Dieldrin is a chlorinated hydrocarbon insecticide and breakdown product of another insecticide, Aldrin. These chemicals have been extensively used on corn in the past but have been banned from further use due to their persistence in the environment. The lack of a great deal of intensive agriculture in the northern part of the Upper Mississippi basin is the only factor which precludes the persistence of Dieldrin from being a basin-wide problem. It is found most frequently in the area of Southern Iowa, where the major tributaries draining the croplands of that state empty into the Mississippi.

Violations of the copper standard for aquatic life occur from Dubuque to Burlington, Iowa. The overall toxicity of copper is reduced by the bicarbonate nature of the river. The importance of copper as a toxic substance in the Mississippi is not known.

Although a suspended sediment standard of practical value has yet to be developed, the sediment load of the Upper Mississippi changes so dramatically that suspended sediment can be called a pollutant in the river below East Central Iowa. The Mississippi opposite Minnesota, Wisconsin and Northern Iowa is clear for a large river. Sediment loads from tributaries within the GREAT II segment increase the suspended sediment load of the river by approximately 700%.

The primary drinking water standard

(health) and the aquatic life standard for lead have been violated in the Mississippi between Dubuque and Burlington. Industrial discharges in that area are considered to be the primary source and dilution and sedimentation are probably responsible for the mitigation of the problem below Burlington.

Bacterial contamination in the river as measured by fecal coliform concentrations show high levels do occur but are usually very localized. Large concentration of fecal coliform bacteria are common below the Quad Cities, but are greatly diminished within 30 miles. Since the State of Illinois classifies the Mississippi for all general uses including whole body contact recreation (swimming, water skiing) the above mentioned segment is in violation of established water quality standards. Most of the remaining segments of the river within GREAT II maintain fecal coliform concentrations near the allowable limits.

Polychlorinated biphenols (PCB's) in the Upper Mississippi pose a greater threat to contamination of the food value of fish and shellfish than to the contamination of drinking water. PCB's have low solubility in water but a great affinity for fine suspended or bottom sediments within the river system. Pools in the Mississippi from the Twin Cities down to and including Lake Pepin (GREAT I) contain fish which exceed the FDA 2 mg/kg standard for PCB's. PCB contamination exceeding FDA limits in fish has been measured in the GREAT II study area. (Illinois Dept. of Public Health, unpublished data).

Large power plants which rely on river water for cooling are responsible for the introduction of great amounts of heat into the river. In most instances these plumes of heated water occupy only a fraction of the channel width and the length of the plume which is 5°F above ambient temperature is less than one mile in length. The major concerns about heat discharges to the river are the effects of ichthyoplankton (fish larvae) and adult fishes, both of which are very sensitive and can be killed by high temperatures or rapid temperature changes.



SEDIMENT AND EROSION

Erosion is the process of detachment and transportation of soil particles. The beating action of rain falling on bare or sparsely covered soil detaches soil particles which are then carried down slope by the runoff water. When the water slows down, the soil particles are deposited as sediment.

Sediment is transported by flowing water. Most of the products of erosion move only a few feet or yards from where they were eroded. A portion of the sediment will, however, reach a channel where it may be carried by the current for long distances before deposition. Some of the finer clay sediments are carried to the ocean. The sediment delivery system is related to channel density, topography and entrapment areas. High sediment yields can be expected from areas that have abundant channels and gullies, steep hilly topography and an absence of lakes and swamps. Conversely, low sediment yields can be expected from areas that have few channels, flat topography and an abundance of swamps and lakes.



The upper portion of the study area is characterized by steep bluffs and valleys—prone to extensive erosion.

The types of sediment carried by flowing water is determined by the different geologic materials available in the watershed that may be subject to erosion. Streams flowing from glacial outwash sand will carry coarse sandy sediment. A wide variety of soil types are common throughout the study area and erosion rates vary. Row crop farming operations which are common throughout the study area create the bulk of fine sediments. Land use in the study area is principally agricultural. Within agricultural land use, crop land is the largest contributor to sediment problems.

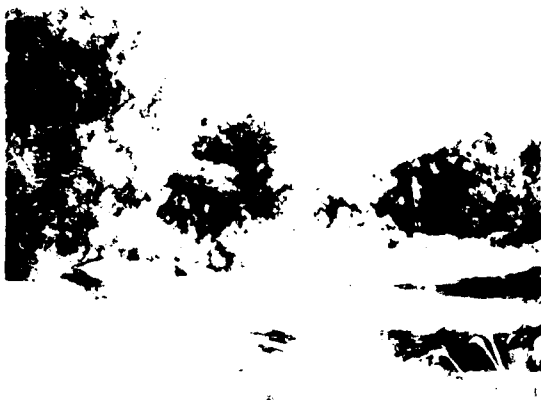
Sedimentation as it relates to dredging was discussed in the Channel Maintenance Section of this chapter. Sedimentation also affects fish production, which through turbidity and deposition, is probably the dominant adverse influence on the quantity and quality of fish, wildlife and their habitat on the river today.

The group of aquatic organisms most frequently affected by siltation are the filter feeding invertebrates, (mussels, benthos). Silt interacts with dissolved oxygen and temperature in a complex manner, clogging gill membranes and interfering with the gaseous exchange of respiration. Overall, benthos and plankton have decreased in diversity, resulting in a less stable, less resilient ecosystem.

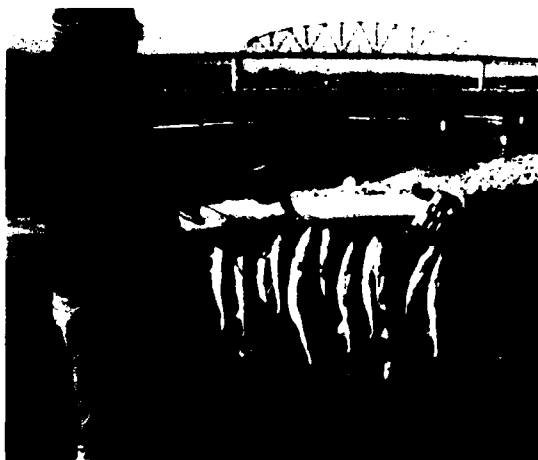
Siltation also traps organic matter on the bottom and creates an oxygen deficiency. Toxic gases are often released under these anaerobic conditions. Silt flocculates planktonic algae and carries it to the bottom to die. It absorbs oil and precipitates, remaining a potential source of pollution when these sediments are resuspended.



Farming creates the bulk of fine sediments that enter the river system.



Side channels and backwaters in the pooled river capture sediment and eventually can become closed.



The waters of the Upper Mississippi River hosts over 70 species of fish.



Freshwater mussels are vital resources to fish, wildlife, and man. Fifty species are known to exist in the study area.

Sedimentation is filling the backwaters and as a result is destroying valuable aquatic and marsh habitat. The GREAT II SCWG has made various predictions on the life expectancy of the backwaters in their work group appendix. (see discussion in Fish and Wildlife Component).



FISH AND WILDLIFE

The Mississippi River Corridor provides a wide variety of habitat types to a diverse number of aquatic and terrestrial species. A stable ecological system is dependent, in part, upon the maintenance of this wide diversity of species. Ecological systems which lose their diversity, by whatever means, are more vulnerable to degradation and/or destruction by disease, starvation, habitat change, etc.

Changes which have occurred in the habitat structure and condition along the Mississippi River, through natural and/or manmade means, reduce the diversity and therefore the stability and integrity of the Mississippi River ecological system.

Aquatic habitats in the GREAT II reach have been defined by the Upper Mississippi River Conservation Committee (UMRCC) for scientific study and resource management. The habitats have been defined as main channel, main channel border, tailwaters, side channel, river lakes and ponds, and sloughs. These aquatic habitats of the Mississippi River support a myriad of fish, amphibians, reptiles and invertebrates. Many other wildlife species utilize these habitats.

A representative sample of fish in the study area would include freshwater drum, gizzard shad, white bass, crappie, walleye, channel catfish, carp, buffalo, largemouth bass, bluegill, suckers and minnows. Discounting all strays which are not typically taken on large rivers or were out of their normal range, there are 81 species that historically or presently characterize the Mississippi in the GREAT II reach. Out of these 81 species, two no longer occur, and seven are considered rare.

Also associated with aquatic habitats are bivalves (clams and freshwater mussels) which are present in the UMR drainage and are vital resources to fish, wildlife and man. These include fingernail clams (especially abundant in Pool 19), the Asiatic clam and 50 species of freshwater mussels.

Nine species found in the GREAT II area

are protected by the Endangered Species Act of 1973 as amended. These are the Indiana bat, gray bat, Ozark big-eared bat, bald eagle, American peregrine falcon, Arctic peregrine falcon, Higgin's eye pearly mussel, fat pocketbook pearly mussel, and a plant, the northern wild monkshood. A significant portion of the bald eagle population migrates through or winters in the GREAT II area. In addition, extensive surveys have been conducted to determine the presence or absence of endangered mussels. Other endangered species may also be affected by man's activities in the floodplain.

Terrestrial habitat within the reaches of the GREAT II study area can be placed into seven major cover type categories. They are aquatic marshlands, herbaceous growth, forestlands, agricultural lands, sand and mud, dredged material and developed lands.

The UMR provides diverse habitat for approximately 300 species of birds. At least 100 species use the river corridor for nesting. The river, part of the Mississippi Flyway, serves as a major north-south migration route for avian wildlife. These include approximately 150 species of passerine birds (commonly referred to as song birds), as well as raptors such as the bald eagle and peregrine falcon, fish eating colonial water birds such as herons and egrets, shorebirds (about 30 species), waterfowl (about 28 species) and numerous other upland game and migratory species. Pool 19 is of particular importance to migrating waterfowl and has international significance with respect to diving ducks. A significant portion of the continental population of canvasbacks use Pool 19 during fall and spring migrations. Mallards make heavy use of this pool as portions of two flyway populations migrate through this area.

Terrestrial habitat along the UMR also supports an abundant and diverse mammal population. Fifty-two mammal species have been identified. Species are listed by pool in the FWMWG Appendix. Some of the most common are muskrat, mink, fox, raccoon, opossum, beaver, white-tailed deer, striped skunk, woodchuck, coyote, short-tailed shrew, deer mouse, white-footed mouse, prairie vole and house mouse.

A total of 20 amphibians and 41 reptiles have ranges which include all or part of the study area. Lists of these species may also be found in the FWMWG Appendix.



The bald eagle is one of the endangered species who live in the study area.



The American egret is one of the common colonial water birds living in the Upper Mississippi River Corridor.



The white-tail deer is the largest of the 52 mammal species known to call the river environment their home.

Approximately 105,000 acres of lands and water are managed by state and federal agencies for fish and wildlife production and protection only and thereby eliminates the potential for multiple use on these lands. Of these 83,712 acres are owned by the COE and are made available through cooperative agreement to the USFWS for conservation, maintenance and management of fish and wildlife resources.

The USFWS also operates portions of two refuges in the GREAT II area: The Upper Mississippi River Wild Life and Fish Refuge and the Mark Twain National Wildlife Refuge.

Use of the fish and wildlife resources of the UMR can be categorized into consumptive and non-consumptive. Consumptive uses include hunting, fishing and trapping. Non-consumptive uses include hiking, bird-watching and photography. Trappers harvested pelts worth approximately \$737,000 annually (1977 dollars). Hunters spend an average 640,000 activity days annually in the GREAT II area and expend approximately \$8.3 million dollars annually (1975 dollars).



Waterfowl hunting opportunities are aided through the management activities on two federal refuges in the river corridor in the study area.

Pools 11 through 22 (GREAT II) of the UMR support a diverse, quality sport fishery. Within the GREAT II study area over 4,899,000 activity days (35% of the total recreation activity) are spent sport fishing on the UMR annually. This accounts for approximately \$50.3 million in expenditures annually.

Commercial fishing on the UMR is a major consumptive use of the resource. During the period of 1953-1977 the reported commercial catch for the study area was 112,830,000 lbs,

with an annual average harvest of 4,500,000 lbs. The reported total first market value for the commercial catch over the 25 year period was \$9,900,000 or an average of \$397,000 per year.

Freshwater mussels are also commercially harvested. Their primary use is in the cultured pearl industry. The commercial harvest in the study area for the State of Iowa alone is estimated to be 469,000 lbs. at an estimated first market value (1978 figures) of \$50,000 annually.



Over the last 25 years the total market value of the commercial fishing "catch" was almost \$10,000,000.

Construction of the locks and dams in the 1930's brought abrupt changes to the aquatic and terrestrial habitat of the UMR. Prior to construction of the locks and dams three major problems affected the aquatic life and habitat of the UMR: 1) pollution, 2) erosion (and consequent sedimentation of backwaters) and, 3) fluctuating water levels. After lock and dam construction studies showed there had been a resultant general increase in total aquatic habitat; a reduction in fluctuating water levels, and a decrease in terrestrial habitat.

Although aquatic habitat was increased by lock and dam construction, the overall effects were temporary. By impounding the river, more cross-section or "conveyance" was created than the flow characteristics can support. In other words, the river is too wide for the amount of water passing through it. The river, therefore, is attempting to restore its pre-impoundment conditions by reducing its cross-section (i.e., filling in the backwaters). In addition, the construction of levees, channel control structures and bank stabilization further restricts the natural meanderings of the river and therefore prevents the creation of new backwater areas.

Since lock and dam construction, approximately 9,000 acres of off-channel water surface area have been converted to various types of vegetation. According to projections made by the Side Channel Work Group, the estimated life of the backwaters is 50-100 years at present rates, and up to 49% of the existing off-channel areas may be lost over the next 50 years due to sedimentation and vegetation.

For the most part, it is the backwaters that are responsible for the quantity and quality of fish and wildlife found on the river today. Off-channel areas provide the most favorable conditions for the existence of the river fishes during certain portions of their life cycle. Loss of these extra channel areas is detrimental to the survival of adult and young fishes. As previously stated, a large portion of the side channel aquatic habitat loss is due to the river's attempt to reduce its cross-sectional area. This loss is inevitable unless levees, channel control structures and bank stabilization are removed from the river, an unlikely event. Other alternatives to preserve and protect backwaters include complete isolation (diking), dredging, side channel openings and closures, or complete control of water flow through the use of water control structures.

Maintenance of the navigation project necessitates dredging and dredged material disposal. In the past, disposal of dredged material has resulted in direct or secondary movement of material into side channels and backwaters. It has been estimated that approximately 1,800 acres of backwater habitat (3% of total) have been impacted by dredged material disposal between 1956 and 1975. Current wind and vessel generated wave erosion, as well as resuspended bottom sediments, have shown to be deposited in backwaters and side channels. Terrestrial habitat is also lost each year to floodplain encroachments such as development for industry, recreation, residential homes and/or agriculture. Other impacts/problems to fish and wildlife resources have been discussed in several of the other sections of this chapter.

There is a general lack of data which can be used by fish and wildlife managers to quantify the relationships between the species and their specific nesting and habitat requirements, and the effects of man-induced changes on these relationships.



CULTURAL AND AESTHETIC

CULTURAL. There are about 1,100 known archaeological sites in the GREAT II reach of the Mississippi River which represent a legacy of cultures 12,000 years long. Most of these sites are of the prehistoric period, although numerous historic sites are known. The importance of these sites varies, but so few have been intensively studied that the record of the prehistoric and early historic period is known only very generally. An additional 3,680 buildings and other structures of the historic period are known to be of some historical and/or architectural importance. Figure #5 displays the various cultural periods and traditions, how the people lived, how they obtained their food, and the kinds of tools they used.

Most of the existing understanding of the prehistory of the river corridor is inferential, relying heavily upon information from archaeological investigations in neighboring states, rather than research in the river corridor proper.



Archaeological sites represent a legacy of the last 12,000 years of man's presence in this area.

As the exact locations of these cultural resources are unknown, there is great potential that these resources are being destroyed by man's activities along the UMR.

The mechanism (legislation) for acquiring these data already requires Federal agencies to conduct cultural resources reconnaissance surveys. This legislation needs to be enforced.

Another problem is that many agency people do not understand the cultural resource policies and concerns. Better interagency coordination is needed.

FIGURE #5
GENERALIZED CULTURAL-HISTORICAL SEQUENCES
OF PAST CULTURES IN THE STUDY AREA

TRADITION	CULTURAL PERIOD	NORTHERN	CENTRAL	SOUTHERN		MAJOR CULTURAL ADDITIONS
ONEOTA MISSISSIPPIAN	HISTORIC		various historical tribes		1500	tribal organization
	MISSISSIPPIAN	Oneota Phases		Mississippian Phases	1400	horticulture temple mounds
EFFIGY MOUND	LATE WOODLAND		named and unnamed Late Woodland Phases		1100	cultural mosaic
					1000	
			numerous local phases		700	increased localization of ceramic traditions
HAVANNA	MIDDLE WOODLAND				500	
			Hopewell Phase		100	
			numerous local phases		0 AD 0 BC	interaction spheres incipient horticulture
			unnamed Early Woodland Phases		500	burial mounds pottery
ARCHAIC	ARCHAIC				1000	regionalization plethora of tool types primary forest efficiency
PALEO INDIAN	PALEO INDIAN				6000	
					12000 ?	fluted points big game hunting hunting and gathering

AESTHETIC. GREAT II has recognized the need to maintain areas of the UMR Corridor in a primitive or natural state and to protect the natural aesthetics. GREAT II has recommended that the wilderness designation, according to federal definition, not be applied to the UMR. It was agreed however that, another method of managing the aesthetic and natural characteristics of the river must be developed. As a result, this report does not specifically address "wilderness." The following discussion pertains to the "aesthetic" quality of the river corridor only.

The definition and management of "aesthetic quality" and "natural areas" is an extremely difficult task. It implies that aesthetic and natural area qualities are defineable. It also assumes that the ability exists to appropriately manage that "quality" for the public.

The use of the word aesthetic or natural implies "preference." A person's preference is based on judgments he or she made as a result of an experience. That experience is created by: sight, sound, smell, taste, touch, and movement. Because these senses vary so greatly between individuals and are influenced by so many factors, it is extremely difficult to predict individual preferences. A particular "setting" may be viewed or perceived differently by a number of individuals even though the elements which make up the setting do not change. Perception can be affected by many factors such as: weather conditions, an individual's background (experience), method of travel, reason for travel, etc.

The problem of managing aesthetic or natural qualities must, therefore, begin with defining these qualities, identifying them in ways applicable to the landscape, and protecting these qualities. State natural heritage surveys provide a starting point to begin to define and identify aesthetic qualities.

PLANNING OBJECTIVES

The UMRBC provided a set of planning guidelines to the GREAT II Team (see PFWG Appendix, Chapter I). These guidelines did not provide for development of a total river management plan. In order to develop a planning strategy that would provide the framework for a complete management plan,

the GREAT II Team developed planning objectives. Taken as a whole, these planning objectives provide the complete framework necessary to develop a comprehensive plan. However, due to time and funding constraints, GREAT II was not able to fulfill all of their planning objectives. In those areas where enough data was available to draw conclusions and analyze alternatives, recommendations were made. In other areas, data were insufficient to draw valid conclusions, and recommendations of further study were made.

The following list displays the broad planning objectives of the GREAT II Team. More specific planning objectives were developed individually by each of the GREAT II functional work groups. The specific planning objectives may be found in the respective work group appendix.

- To identify present and future problems in river navigation.
 - To identify the needs created by these problems.
 - To identify alternative ways to meet these needs.
- To determine the means, and to make recommendations, for preserving and protecting the cultural resources of the GREAT II reach of the UMR.
- To identify and develop ways to use dredged material as a valuable resource for productive uses.
- To reduce the quantity of dredged material in the short-term (site-specific each dredging occurrence) and still maintain a safe navigable channel.
 - To reduce the quantity of dredged material in the long-term by determining channel depths and widths to minimize dredging quantities, and still maintain a safe navigable channel and, to make more use of regulatory structures to prevent channel shoaling.
- To determine the means and to make recommendations for preserving, protecting and enhancing the fish and wildlife resources of the UMR.
- To strive to comply with State and local regulations concerning dredging and dredged material disposal, and to perform those studies necessary to develop unified floodplain management along the GREAT II reach of the UMR.

- To assure necessary equipment to maintain the total river resources on the UMR in an environmentally sound manner.
- To develop procedures for assuring an appropriate level of public participation.
- To eliminate adverse effects to recreation resulting from channel maintenance activities. To enhance recreational benefits of the river corridor from channel maintenance activities.

To enhance recreational use of the river corridor consistent with maintaining the quality of the corridor's natural resources by adequate distribution of related recreational opportunities, to maintain the integrity of the recreation viewshed, and, to distribute information on study findings.

- To determine the source(s) of sediment causing dredging and sedimentation; to determine the quantity of sediment entering the river corridor from these sources, and to propose land treatment and land management alternatives to alleviate the sedimentation.
- To make resource management recommendations that will insure the protection and/or enhancement of fish and wildlife resources and their enjoyment and utilization by the public in off-channel (side channel, backwater) areas, this being in the context of an artificially controlled, riverine ecosystem operated and maintained for commercial navigation.
- To promote the improvement and/or maintenance of water quality in the GREAT II area.

Although a specific objective was not developed in regard to commercial and industrial development, GREAT II recognized

the need for research in this area. As no work group was specifically responsible for this element, limited research was conducted and recommendations made were for further study only.

The following section summarizes the activities, studies, results, conclusions and recommendations of the GREAT II functional work groups.

ACTIVITIES AND RECOMMENDATIONS

The following set of tables (From Problem To Recommendation) summarize by component the major problems studied and recommendations developed by the GREAT II functional work groups. The recommendations as displayed in these tables do not show the final wording as approved by the GREAT II Team. They are included as a guide to aid the reader in following the process from the problem stage to the final recommended plan. Studies and work group activities are listed as supporting data to the final recommendations. A detailed description of the work group studies, results and conclusions may be found in the appropriate work group appendix.

The recommendation numbers are displayed here in the same order as they appear in the recommended plan. Please refer to Chapter 3 for a display of the recommended plan as modified, synthesized and approved by the GREAT II Team.



TABLE VII-1
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: COMMERCIAL TRANSPORTATION

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
1. Lock Congestion	Improve efficiency of locking crews: CTWG 5509	PREP 1	1	CTWG Consultations CTWG Discussions RWG Discussions Industry Comments A. T. Kearney Report
2. Inefficient Use of Locks	Provide information signs, access ramps, holding areas: RWG 1005			
3. Recreation Versus Commercial Lock Conflicts	Provide craft waiting areas, launch facilities, information via radio: CTWG 5516			
4. Lock Constraints to Barge Traffic	Provide for advanced planning and design of UMR navigation system: CTWG 5504			
	Improve safety at locks (study): CTWG 5505			
	Maintain auxiliary locks for recreation: RWG 1014, 1015			
	Construct mooring cells and extend guidewalls (Pools 20, 21, 22) CTWG 5506, 5507, 5508			
5. Outdated Navigation Charts	Update navigation charts: CTWG 5524	PREP 2	2	CTWG Discussions Field Interviews
6. Insufficient Aids and Services to Navigation	USCG improve its navigation aids program: CTWG 5512	PREP 4	3	CTWG Discussions Industry Interviews RID/COE Interviews
7. Barge Delays and Hazards Due to Operating Type Bridges	Enforce drawbridge operation regulations: CTWG 5514	PREP 5	4	GREAT I Report Review CTWG II Bridge Report CTWG Discussions Drawbridge Analysis Literature Review
	Remove obstructive bridges: CTWG 5513			
	Study projected traffic over drawbridges: CTWG 5523			

TABLE VII-1
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: COMMERCIAL TRANSPORTATION

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
7. Barge Delays (con't.)	Improved detectability of obstructions: CTWG 5515			
	Implement recommendations of CTWG study on collisions: CTWG 5525			
8. Insufficient and inefficient coordination between various modes of transportation	Improve intermodal transportation systems: CTWG 5522	PREP 6	5	CTWG Discussions
9. Legal and institutional constraints in obtaining fleetings and terminal permits	State and Federal agencies to streamline permitting processes: CTWG 5521	PREP 7	6	GREAT I Report Review GREAT II Field Interviews National Waterways Study Interviews
10. Impacts of barge fleetings unknown	Study environmental and economic impacts of barge fleetings on UMR: FWMWG 3034	PREP 48	7	FWMWG II Discussions FWMWG II Review of Literature FWMWG II Fleetings Area Observations CTWG II Fleetings Area Study

**TABLE VII-2
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: CHANNEL MAINTENANCE CONCERNS**

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
11. Current condition of the regulatory structures is unknown	Adopt permanent committee for assessment of regulatory structures: DRWG 4006	PREP 9	8 (See Channel Maintenance Handbook; Supplement to the Main Report)	Sediment Transport Model Study Review of dredging records Regulating structure assessment by COE Study DRWG Discussions GREAT II FWMWG Wing Dam Notching Study FWMWG Discussions GREAT II FWMWG Wing Dam Classification Study FWMWG I Appendix Review of aerial photos Literature review Study by Iowa Institute of Hydraulic Research
12. Need to reduce dredging in short-term	Perform detailed hydrographic surveys of each cut: DRWG 4002			
13. Effectiveness of regulatory structures is unknown	Calibrate sediment transport model: DRWG 4003 Continue wing dam study: FWMWG 3025			
14. Information on impacts of regulatory structures on fish and wildlife is needed.	RID/COE: evaluate regulatory structures at recurrent dredging sites: FWMWG 3008			
15. Disposal problems to fish and wildlife in recurrent dredging areas	Consider fish and wildlife when modifying or constructing regulatory structures: FWMWG 3007; DRWG 4009			
16. Modifications and/or construction of regulatory structures affect fish and wildlife	Repair of structure in Pool 20 (Case Study) (Same as FWMWG 3007) SCWG 3507			
17. Need to reduce dredging in the long-term through assessment of hydraulic factors	RID/COE study recommended regulatory structures: DRWG 4012			
18. Hazardous drawdown conditions in Pool 15 at lock	Increase dredging at lock: CFWG 5511	PREP 10		CTWG II Consultations with RID/COE Analysis of Accident Data COE Interviews CTWG Discussions Review of barge channel effects studies Interviews with towboat captains
19. Areas of channel do not provide sufficient width, depth or alignment for safe navigation (9-foot draft vessels)	Straiten channel alignment and remove rocks: (R.M. 489) CFWG 5510 COE insure that channel depths not fall below 11.0 feet: CFWG 5502			

TABLE VII-2
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: CHANNEL MAINTENANCE CONCERNS

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
19. Areas of channel (con't.)				GREAT II CTWG / DRWG Studies
20. Fish and wildlife adversely affected by RID/COE dredging and disposal practices	RID/COE should request necessary appropriations to purchase effective and efficient dredging equipment or contract with private firms to do the same.	PREP 11	8 con't.	Annual dredge disposal review FWMWG Discussion MENWG II Discussions SCWG literature review Side channel inventory Side channel openings SCWG Discussions DRWG Discussions Current COE policy
21. Existing RID/COE dredging equipment is insufficient to do channel maintenance dredging in an environmentally sound manner	(Capable of reaching GREAT II approved disposal sites): FWMWG 3001, SCWG 3501, DRWG 4007			
22. Need to select disposal sites incorporating concerns of all resources	PFWG approved disposal sites: PFWG 6001-6153, PFWG 6245-6261	PREP 12		DSSTI Meetings PFWG II Meetings & Discussion Review of GREAT I & II Side Channel Openings Reports Review of aerial photos GREAT II area Johnson Report "Determining Means of Enhancing & Maintaining Recreation Areas with Dredged Material"
23. Fish and wildlife affected by turbidity and sedimentation resulting from upland and stream-bank erosion	Protect Browns Lake Complex: FWMWG 3036 Formally establish and support OSIT & consider recreation in placement: RWG 1001			GREAT II Preliminary Feasibility Report GREAT II Plan of Action Report RWQG Discussions WQWG Discussions Discussions with Waterways
24. Need for on-going structure in selection of disposal sites	Locate sites to minimize erosion: RWG 1002 During Disposal, observe natural features: RWG 1003			
25. Secondary movement of material	RID/COE use WQWG models to assess impacts of disposal on water quality: WQWG 2			
26. Lack of data pertaining to surface and groundwater quality as it is affected by dredging and disposal	UMRCC develop a plan for RID/COE to monitor short-term disposal sites: FWMWG 3030			
27. Lack of ability to predict re-	OSIT at Savanna Proving Grounds prior to			

TABLE VII-2
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: CHANNEL MAINTENANCE CONCERNS

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
<p>ponse of fish and wildlife to certain alterations of environment</p>	<p>disposal: WQWG 10</p> <p>Utilize beneficial use sites as recommended by DMUWG: DMUWG 4505</p> <p>Utilize GREAT II approved sites: DRWG 4001</p> <p>Upgrade, maintain or repair identified levees: FWMWG 3010</p> <p>Obtain HCRS approval as needed in disposal: RWG 1031</p> <p>RID/COE conduct surveys for cultural resources on proposed disposal sites: CRWG 5002</p>			<p>Experiment Station</p> <p>Lab simulation of desorption of pollutants</p> <p>Assessment of dredge disposal related water quality problems</p>
<p>28. Dredged material has not been disposed of where available for beneficial use</p>	<p>Eliminate unwanted disposal on refuge lands: FWMWG 3019</p>	<p>PREP 12 con't.</p>	<p>8 con't.</p>	<p>GREAT II FWMWG Bibliography</p> <p>FWMWG Discussions</p> <p>OSIT Discussions</p> <p>WQWG Discussions with RID/COE and State Water Quality Management Agencies</p> <p>RWG Discussions</p> <p>LAWCON Project Inventory</p> <p>HCRS Regulations</p> <p>CRWG Literature search and inventory study</p> <p>CRWG review of GREAT II projects and placement sites</p> <p>CRWG Discussions</p>
<p>29. Disposal has caused blockages of side channels and losses of habitat in backwater areas</p>	<p>Prohibit COE from disposal in wetlands, side channels, sloughs, etc: SCWG 3502</p>			

TABLE VII-2
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: CHANNEL MAINTENANCE CONCERNS

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
29. Disposal (con't.)				Upper Mississippi Dredge Spoil survey DMUWG Appendix SCWG Literature review Side Channel Inventory Side Channel Openings SCWG Discussions
30. Legal problems may arise if COE uses new disposal sites on private land	COE utilize present policy of charging for dredged material transport and disposal: DMUWG 4501	PREP 13	8 con't.	DMUWG Legal Study DMUWG Discussions with Sand and Gravel Producers
31. Properties and uses of dredged material unknown	Consider dredged material as a fine aggregate source: DMUWG 4503 Make available (dredged material) to identified requestors: DMUWG 4504	PREP 14		I.S.U. Study: Waste Dredged Material for Construction DMUWG Market Study



TABLE VII-3
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: COMMERCIAL/INDUSTRIAL/UTILITY CONCERNS



SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
32. Lack of data on the effects of GREAT II recommendations on commerce, industry and utilities	Conduct studies to determine impacts: PFWG 6324	PREP 16	9	PFWG Discussions



TABLE VII-4
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: FLOODPLAIN ENCROACHMENT & DEVELOPMENT



SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
33. Lack of coordination between states and agencies—resultant discrepancies in floodplain management	Develop and implement interstate floodplain compact: FPMWG 2501	PREP 63	10	FPMWG Legal and Institutional Study FPMWG Discussion Unified National Program for Floodplain Management National Flood Insurance Program E. O. 11988 W. R. C. —P&S House Document 465
34. Lack of detailed floodway/floodplain mapping	FEMA seek adequate funding to provide flood boundary/floodway maps: FPMWG 2502	PREP 18	11	FPMWG Mapping 1965 & 1973 Floods FPMWG Discussions Unified National Program for Floodplain Management
35. Lack of data on the impacts of past, present and future floodplain management practices on flood heights	Support requests for a feasibility study on math modeling of flood flows: FPMWG 2506	PREP 19		UMRBC Technical Flood Plain Management Task Force FPMWG Appendix
36. Need for agreed upon model which accounts effects of sediment aggradation on flood heights	COE conduct literature review to determine if sediment accretion and plant succession affect flooding: FPMWG 2505	PREP 20	12	FPMWG Appendix

**TABLE VII-5
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: RECREATION CONCERNS**

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
37. Private leases preclude present and future needs for expansion of recreational facilities	Termination of private leases according to COE policy and where a demonstrated recreation need exists: RWG 1006	PREP 27	13	RWG Discussions RWG Facility Inventory RWG Needs Analysis SCORP'S Recreational Use Survey
38. Supply of existing developed and undeveloped recreation areas is unknown	Inventory of undeveloped areas and utilize existing facility inventory: RWG 1032	PREP 22	14	RWG Discussions 1977 GREAT II Recreational Facility Inventory Recreation Use Survey Recreation Monitoring Methodology
39. Lack of data on recreational users; their use patterns, etc.	Develop and conduct statistically reliable recreation survey: RWG 1021	PREP 62	15	RWG Discussions Recreational Needs Analysis Use Projection Reports RWG II Selected SCORPS Facility Inventory RWG II
40. SCORP's do not coordinate enough interstate and do not place enough emphasis on the Mississippi River	Coordinate SCORP activities and include the Mississippi as a SCORP subject: RWG 1033	PREP 23	16	Recreation Needs Analysis RWG Discussions Recreation Use Projections and Needs Reports On-Site Inspections RWG II Master Plans State SCORPS
41. Need additional access on UMR	Establish management objectives for each pool: RWG 1008	PREP 24	17	Levee District Meeting GREAT II area RWG Discussions Levee District Presentation Johnson Report
42. Carrying capacity is unknown	Prepare recreation plan for Pool 19: RWG 1035			
43. Future "need" is unknown	Study and evaluate each pool (11-22)			
44. Certain pools lack adequate facilities	recreational needs and potentials: RWG 1038-1049			
45. Certain pools lack adequate access	Provide for access in pool 19: RWG 1035			
46. Levees are adversely affected by recreational access over them and	Improve road access, land buffers along river, planting buffers, improve parking: RWG 1004			

**TABLE VII-5
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: RECREATION CONCERNS**

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
by wave-generated erosion	Develop recreation sites accessible by automobile: RWG 1010			Boating Safety Report Needs Analysis
47. Lack of adequate access for recreation users without boats	Coordinate recreation access within total management plan: RWG 1019			Public Meetings--GREAT II RWG II Discussions
48. Recreation use may conflict with commercial and environmental concerns	RID/COE develop set of generalized planning guidelines for locating and designing access areas: RWG 1050			Boating Safety Report--RWG II Coast Guard Publication
49. Need for planning and design guidelines for access areas	Provide no-wake zones, construct protective structures, relocate facilities: RWG 1036		17	
50. Recreation facilities and moored craft are damaged by wakes from moving craft				
51. Litter is degrading existing recreational areas	Enforce litter laws, promote take-it-home campaign, provide more trash receptacles, public education programs: RWG 1028	PREP 25	18	Rec. Use Survey -- GREAT II Boating Safety Report -- RWG II Maintenance and Enhancement of Island Beach Report -- RWG II Disc. RWG II Discussions
52. Need additional recreational trails along UMR	Maintain abandoned railroad rights of way, acquire new trails, coordinate with GREAT river road activities: RWG 1011	PREP 28	19	RWG II Discussions RWG II Facility Inventory
53. Excessively noisy craft on UMR	Establish decibel limits and enforce these limits: RWG 1012	PREP 30	20	RWG II Discussions
54. Funding sources inadequate to meet recreation needs	Increase funding to identified programs: RWG 1034	PREP 29	21	RWG II Discussions Funding Regulations

TABLE VII-5
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: RECREATION CONCERNS

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
55. Extended residency on boat-house permits has created sanitary problems and conflicts with other uses.	Control issuance of boathouse permits	PREP 69	22	GREAT I Final Report GREAT II Team discussions

**TABLE VII-6
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: WATER QUALITY CONCERNS**

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA RECOMMENDATION ORIGIN
56. Lack of coordinated water quality and sediment data in the study area	Further research on water quality and aquatic habitat impacts of suspended sediment-develop water quality criteria: WQWG 1	PREP 31	23	WQWG II Discussions with RID/COE, WES, and States of Wisconsin, Iowa, Illinois and Missouri
57. Effluent from toxic spills along or in UMR adversely affect fish and wildlife.	U.S.C.G. strictly enforce existing regulations and complete new regulations: FWMWG 3037	PREP 32	24	Clean Water Act USEPA Consultations 43FR58946-59028
58. Existing regulations are insufficient and not enforced	USEPA and states strictly enforce toxic spill regulations. Complete new regulations where necessary: FWMWG 3038			FWMWGII Rev. of Literature 49CFR Parts 171 and 176 46CFR Parts 30-40, 64, 98, 148, 151
59. Unregulated production and storage of toxic materials in floodplain presents hazards to fish and wildlife	Require industries in floodplain that store toxic materials to be floodproofed: FWMWG 3022	PREP 33	25	FWMWG II Discussions Discussions with State and Federal EPA Review of Current Regulations WQWG II Appendix 40CFR Part 250 43FR 58946-59025
60. Thermal pollution from nuclear plants may degrade water quality	Require all thermal monitoring reports for UMR have an identical format. WQWG 7	PREP 34	26	Thermal monitoring reports for power plants in the GREAT II, III study area Water Quality Assessment Report
61. Urban runoff may be contributing to sediment, oil and grease, organics and other pollutants in UMR	Develop group of water quality monitoring stations below a major urban area: WQWG 8	PREP 35	27	WQWG II Discussions
62. Poor water quality limits some	Water quality projects should include a	PREP 36	28	RWG II Discussions

TABLE VII - 6
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: WATER QUALITY CONCERNS

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
recreation uses	recreation weighting factor. RWG 1024			
63. Point source discharges contribute many pollutants to the river	Promote more and better industrial pretreatment of wastes. WQWG 5	PREP 51	29	WQWG II - Water Quality Assessment Report
64. Lack of water quality information presents health hazards to recreation users of UMR	Monitor water quality for fecal coliform at major recreation use areas along UMR. RWG 1025	PREP 37	30	RWG II Discussions
65. Sanitary pumpouts for recreation craft are limited	Provide sanitary pumpouts at marinas, major public facilities, docks and urban areas along UMR. RWG 1016, CTWG 5518	PREP 40	31	RWG II Discussions CTWG II Discussions
66. Toxic spills from railroads along UMR impact fish and wildlife	Priority to upgrading railroad lines along UMR. Enforce speed limits. Educate train personnel. FWMWG 3020	PREP 38	32	FWMWG II Discussions USEPA Consultations USFWS Consultations
67. Immediate response to toxic spills is necessary to protect fish and wildlife. Limited manpower available	Contingency plans stressing fish and wildlife be developed for each pool. FWMWG 3021	PREP 39	33	FWMWG II Discussions Pollution Response Plan for Oil and Hazardous Substances USFWS 40CFR Part 1510

TABLE VII-7
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: SEDIMENT AND EROSION

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
68. Excessive upland erosion	Adequately treat 80% of upland areas: SECWG 502	PREP 41	34	SECWG Discussions Analysis of upland treatment costs FWMWG Review of SCS programs Review SEWG I Studies Review aerial photographs LePage (1979) Lindstrom (1979) Culver (1979)
69. Fish and wildlife habitats are affected by upland erosion	Intensify efforts to reduce upland erosion: FWMWG 3003 Encourage no-till farming, promote upland soil conservation techniques: SCWG 3505			
70. Lack of bedload and suspended sediment gaging data	Install additional gages on selected tributary streams: SECWG 501	PREP 42	35	SECWG II Assessment of available field sedimentation data for GREAT II area and installation of sample gaging stations
71. Lack of information about streambank erosion	Additional streambank erosion studies: SECWG 503 Locate cultural sites likely to be lost by streambank erosion along UMR: CRWG 5005 Protective structures along shore, relocate facilities, etc: RWG 1036	PREP 44	36	SECWG II Discussions CRWG II Literature Search and Inventory Study CRWG II Analysis of effects of lock and dam construction RWG II Discussions RWG II Boating Safety Report
72. Sedimentation is filling off-channel areas at an unknown rate	Off-channel areas be monitored to provide estimate of sedimentation rate. Priorities prepared: FWMWG 3002, SCWG 3503	PREP 43 PREP 72	37	FWMWG II Discussions SCWG II Discussions GREAT I SECWG Appendix Ritchie, J. C. "Sediment Fish and Fish Habitat" GREAT II Team Discussions

TABLE VII-7
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: SEDIMENT AND EROSION

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
73. Boat harbors and access areas filling with sediment	Relocate or redesign problem harbors and access areas: RWG 1013	PREP 64	38	RWG II Discussions



TABLE VII-8
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: FISH AND WILDLIFE IMPACTS & ENCROACHMENTS



SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
74. Pool 19 fish and wildlife management difficult: lack of public land and coordinated planning	Comprehensive fish and wildlife plan for Pool 19: SCWG 3511	PREP 45	39	SCWG II Discussions FWMWG II Discussions SCWG II Appendix
75. Lack of a comprehensive plan for all UMR F&W resources	(Same as 3511) FWMWG 3039 Develop comprehensive F&W management plan for UMR: FWMWG 3017			FWMWG II Appendix GREAT II FWMWG and SEWG Technical Reports Results of GREAT II OSIT
76. Lack of continued coordination among F&W management agencies	Establish F&W Interagency Committee: FWMWG 3004			
77. Inadequate data on the distribution and abundance of fish and wildlife resources	Monitor federal and state endangered species: FWMWG 3031 Complete GIS through UMR: FWMWG 3024 Systematically collect all F&W resource data: FWMWG 3026 Annually monitor colonial birds: FWMWG 3014 Completion of Stage 3 of Submergent Characteristics Study: FWMWG 3013	PREP 46	40	FWMWG II Discussions Endangered Species Act, 1973, as amended FWMWG II Literature Search and review UMRCC Technical Committees Discussions FWMWG II Identify Gaps in Literature FWMWG II Submergent Characteristics Study GREAT I FWMWG Pilot Study
78. Methods for restoring backwaters have not been fully explored	Conduct pilot study to determine feasibility of dredging a silted backwater: SCWG: 3508	PREP 47 PREP 49	41	SCWG II Appendix Burnt Pocket Opening and Study MENWG II Discussions SCWG II Orton-Fabius Opening Side Channel Inventory Side Channel Openings SCWG II Literature Review SCWG II Discussions
79. Lack of data regarding consequences of backwater alterations	Refine through models the capability to predict consequences of backwater alterations: SCWG 3512			
80. No equipment is known that is capable of efficiently dredging backwaters	Research the type of equipment necessary for backwater alterations: SCWG 3510, FWMWG 3028			

TABLE VII-8
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: FISH AND WILDLIFE IMPACTS & ENCROACHMENTS

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
81. Lack of data on the use of backwater silt for vegetative enhancement of islands and/or agricultural fields	Complete dredging and habitat development project: FWMWG 3027 Study priority areas for potential backwater restoration: FWMWG 3035 SCWG 3508 Provide COE with funding to perform selected backwater alterations: FWMWG 3006, SCWG 3504			FWMWG II Appendix SCWG II Bibliography Citations Fulton Flood Control Project EIS FWMWG II Discussions WES Consultations
82. Cumulative impacts of fish and wildlife encroachments are poorly documented	Study cumulative effects of increased industrial municipal, residential and recreational encroachment on F&W habitat, and effects of regulations on development: FWMWG 3029	PREP 71	42	GREAT II Study: Commercial River Transportation Needs FWMWG II Appendix GREAT II Team discussions
83. Fish and Wildlife are affected by commercial and recreational traffic	Conduct study to address impacts of commercial and recreational navigation on fish and wildlife: FWMWG 3032 Identification of measures that can be used for mitigation, restoration, protection, management and enhancement of environmental resources: FWMWG 3033 Complete biological studies to determine fish and wildlife impacts of year round navigation: FWMWG 3023	PREP 50	43	FWMWG II discussions PL9550, Replacement of Locks and Dam 26 UMRBC Master Plan Proposals "Identification and Review of Measures to Enhance and Mitigate Environmental Resources of the UMR System" "Overview Work Plan for Evaluation of the Impacts of Navigation and Navigation Project Operation and Maintenance Procedures on Selected Environmental Parameters."

TABLE VII-9
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: CULTURAL & AESTHETIC NEEDS

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
84. Need to identify and protect natural/scenic areas	Complete natural history survey: RWG 1022 Develop plan to protect areas identified in natural history survey: RWG 1023	PREP 53	44	RWG II Discussions and Facility Inventory RWG II Recreation Use Survey
85. Need to maintain the aesthetic quality of the view for the recreational user	Encourage development of terminal complexes, rather than strip development: RWG 1018	PREP 54	45	RWG II Discussions
86. Systematic survey data are lacking for past, present and most potential disposal sites	Implement incremental approach to collecting resource data: CRWG 5001	PREP 55	46	CRWG II Discussions with RID/COE and DOI-HCRS CRWG II Literature Search and Inventory Data CRWG II Review and Development of Management Policies and Procedures CRWG II Analysis of effects of lock and dam construction
87. Locations of cultural resources along UMR are unknown	Conduct pool by pool bank survey: CRWG 5005			USDA County Soil Surveys
88. Cultural resources are being lost due to river management encroachments, lack of enforcement of regulations, etc.	Conduct geomorphic studies: CRWG 5006 Conduct historical survey of navigation system: CRWG 5007 Expand COE policy on removal of sunken wrecks: CTWG 5519			Past Reconnaissance Survey Reports National Register Criteria CTWG II Discussions
89. Cultural resource regulations of COE are vague and variably applied	Conduct regular workshops to define COE cultural resource procedures: CRWG 5003	PREP 56	47	CRWG II Discussions CRWG II Consultation with State Preservation Program Staffs
90. Floodplain development results	Encourage states and local governments to	PREP 57	48	Proceedings of National Conference of State Historic Preservation Officers CRWG II Discussions

TABLE VII-9
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: CULTURAL & AESTHETIC NEEDS

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
	survey for cultural resources prior to development CRWG 5004		48 con't.	CRWG II Analysis of Lock and Dam Construction

TABLE VII-10
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: PUBLIC PARTICIPATION NEEDS

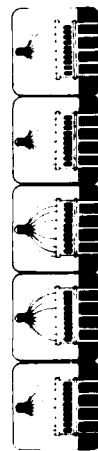
SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
91. Need to keep general public informed	Independent contractor develop public information program: PPIWG 1502	PREP 58	49	PPIWG II Executive Board Discussions
92. Need to educate general public of UMR hazards and opportunities	Independent office for education information: PPIWG 1501			Public Meeting Input-GREAT GREAT I & II
93. Need to encourage more public participation	Develop aggressive floodplain management education program: FPMWG 2503			GREAT II Public Information Program
94. Lack of public understanding of floodplain management	Promote public education litter program: RWG 1028			FPMWG II Discussions Unified National Program for Floodplain Management
	Promote boater safety program: RWG 1030			RWG II Discussions, Use Survey, Boating Safety Report, Maintenance and Enhancement Report
95. Need to encourage more public involvement in management studies	Develop pamphlets, facility guides, canned programs, films, slide shows, etc., for public use: RWG 1020			
	Reimburse active public in future management studies: PPIWG 1505	PREP 59	50	Master Plan PPI Program GREAT II PPI Program
96. Lack of adequate bibliography for floodplain information in RID/COE	Develop program to arrange and manage archives: FPMWG 2504	PREP 17	51	FPMWG II Discussions FPMWG Bibliography Research

TABLE VII-11
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: NEEDS FOR ONGOING COORDINATION

SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
97. A need for on-going coordination and planning for the UMR system, in order to oversee the completion of the total UMR management plan	All of the listed recommendations deal with coordination and/or further study needs which require interagency/interresource coordination: RWG 1007 CRWG 5005 RWG 1001 FWMWG 3004 FWMWG 3024 RWG 1008 WQWG 6 FWMWG 3016 RWG 1035 RWG 1027 RWG 1026 RWG 1023 CTWG 5520 RWG 1017 DRWG 4011 FPMWG 2501 FWMWG 3031 RWG 1020 RWG 1029 RWG 1005 RWG 1021	PREP 60 PREP 66	52 53	All GREAT II Work Group Discussions and Reports
98. Lack of coordinated comprehensive data system for UMR resources and uses	Complete a computerized resource information system for all resources and its source uses in the UMR corridor	PREP 73	54	GREAT II Team Discussions GREAT II OSIT GREAT II Plan Formulation Technical and Appendix Appendum.



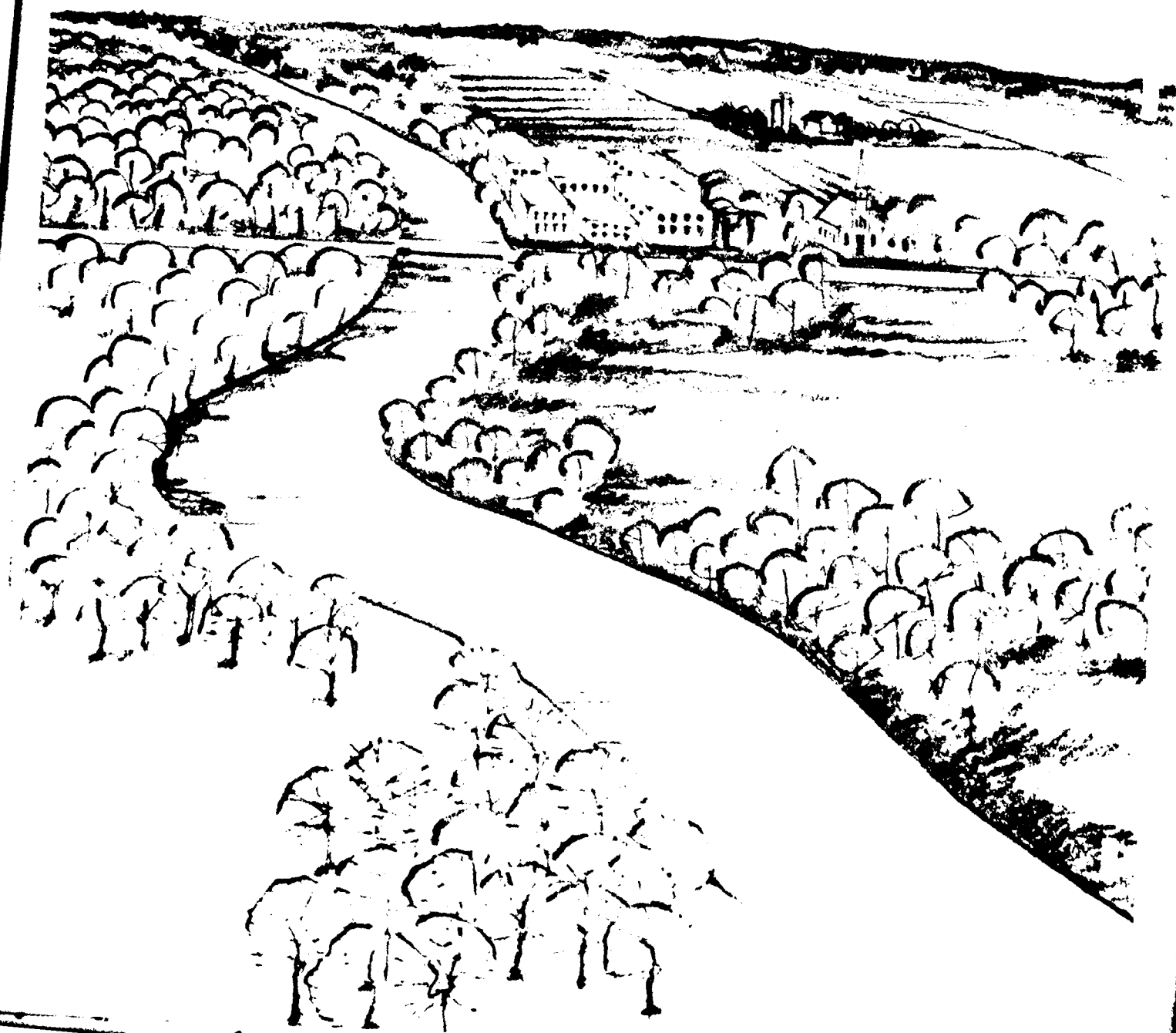
TABLE VII-12
FROM PROBLEM TO RECOMMENDATION
GENERAL PROBLEM: LEGISLATIVE NEEDS



SPECIFIC PROBLEMS	PRELIMINARY RECOMMENDATIONS	SYNTHESIZED RECOMMENDATIONS	FINAL RECOMMENDATION NUMBER	DATA ORIGIN
99. Inadequate capability and authority for COE to actively consider fish and wildlife and recreation needs	Include fish and wildlife as project purpose of the 9-foot navigation project: FWMWG 3012.3006 Include recreation as a project purpose of the 9-foot navigation project: RWG 1037	PREP 61	55	FWMWG II Discussions RWG II Discussions GREAT I FWMWG Appendix GREAT II Aerial Photo Interpretation FWMWG II Appendix
100. RID/COE restricted from considering recreation needs in areas without a local cost sharing partner	Amend PL 89-72: RWG 1037	PREP 61	56	RWG II Discussions RWG II Appendix PL 89-72

THE PLAN

chapter 12**3**45



"There may be land use planning conflicts between resource recommendations, but the planning system forces a manager to look at the total mix, and in the process of comparing values certain alternatives develop. Thus, decisions are based on resolutions, not preconceived notions. This could be the most unique thing about this part of the planning system—it is a discovery or learning process and departs from traditional planning concepts that are sometimes based on past trends."

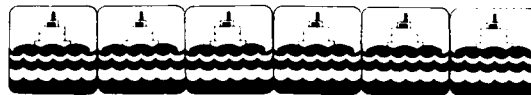
**Multiple Objective Planning Workshop
Bureau of Land Management, Department of the Interior**

The following chapter displays the recommended plan as developed and approved by the GREAT II Team. The plan is organized by components, the nine discussed in Chapter II and two additional, the Coordination and Legislation components. The two additional components were added to provide mechanisms for the on-going coordination, funding and authority necessary to implement the GREAT II recommended plan. Within each component are recommendations that specifically deal with that segment of river management. These recommendations are numbered consecutively.

The impacts of this plan and the procedures and agencies responsible for implementation are discussed in subsequent chapters.

Where time and funding constraints limited the extent of GREAT II's problem resolution and recommendation capabilities for a given component, the Team identified the additional studies and/or data needed to complete a plan for that component. The Channel Maintenance Component, as explained in Chapter I, received the greatest emphasis in the GREAT II studies. The resultant Channel Maintenance Plan, due to its length, detail and complexity is contained in a separate document, the Channel Maintenance Handbook. A singular recommendation signifying that the Team has adopted the Channel Maintenance Handbook is contained in the Channel Maintenance Component of this chapter.

COMMERCIAL TRANSPORTATION



RECOMMENDATION 1. The Barge Traffic Forecast Study conducted by the CTWG shows that significant increases in commercial vessel and recreational craft traffic are predicted for the UMR over the next 20 years. The RID/COE should develop a program to conduct advance planning of the UMR navigation system so that locks whose capacity will be exceeded can be identified and studied in accordance with existing legislation. Advance planning is desirable to determine those measures necessary to improve lock capacity, in coordination with environmental concerns and to implement those measures so to avoid the development of extreme congestion, delays and hazardous conditions in the lock areas.

As GREAT II did not specifically study the impacts of barge traffic (and increased traffic) on the environment, the RID advance planning program should include (but not be limited to) the following:

- A study to determine the effects of barge traffic (and increased traffic) on the environment. This study would then provide additional information for the advance planning program.

- Coordination with and utilization of the results of the Master Plan Study to determine the carrying capacity of the UMR.
- If the Master Plan does not complete this study the RID/COE should include this study as part of their advance planning program.

In order to improve the safety and locking efficiency of the existing locks for both commercial and recreational interests while this program is being developed, the RID/COE should develop a plan to institute the following specific non-structural and structural measures. Appropriate feasibility studies must be conducted prior to development of structural measures.

Non-structural measures would include, but not be limited to the following:

- Improvement of efficiency by providing average lock processing times for each lock to the barge and towing industry. These processing times could be used as a standard against which to judge their crew performance and provide for improved crew training where necessary to reduce locking times.
- Improvement of safety by installing 'locking' information signs at each lock. These signs would give recreational boaters an indication of the next 'locking time' for recreational craft. This information would also be broadcast on local radio stations and/or on a COE low power AM radio network. CB radios could also be installed at the lock and locking information broadcast to boaters via the radios.
- Improvement of lock congestion by implementing sequenced locking procedures at Lock 22, as Lock 22 experiences heavy congestion.

Structural measures to be considered in this program would include:

- Establishment of lock waiting areas at each lock and dam.
- Establishment of boat launching facilities in each pool as identified in recommendations 14, 16 and 17, to reduce the necessity for recreation lockage.
- Construction of a mooring cell just north of Lock 22 for commercial barges.
- Extension of the upper and lower guidewalls at Locks 20, 21 and 22.



Provision of additional boat launching areas can reduce the demand for recreational craft lockages.

The plans for structural measures must be developed in accordance with all existing environmental regulations and special consideration given to:

- Evaluating the historical significance of the structures in relation to overall navigation.
- Providing for mitigation of fish and wildlife impacts, measured in habitat units and calculated on secondary as well as primary impacts. (See Section IVG in CM Handbook)
- Providing for adequate mitigation of associated bank erosion.
- Considering the needs of recreation (i.e., nearby boat ramps) when placing structures.

RECOMMENDATION 2. The NCD/COE should update navigation charts of the UMR and reorganize the pages in consecutive order. The new charts should include more data on bridge clearances, highline crossing clearances, navigation aids, etc.

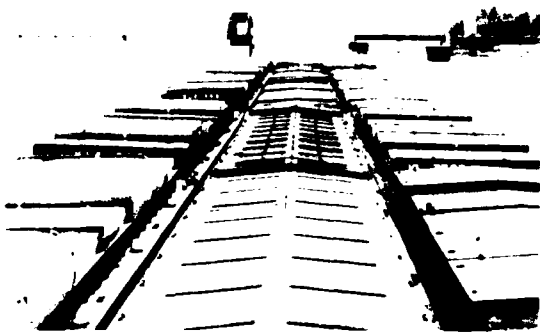
Also, areas within the Upper Mississippi Wild Life and Fish Refuge and Mark Twain National Wildlife Refuge should be clearly identified on navigation charts. In addition, the NCD/COE should develop individual pool navigation charts for recreation boaters which emphasize boating hazards, access sites, service areas, safety tips, laws on "rules of the road" and emergency service information.

RECOMMENDATION 3. The USCG should improve its navigation aids program in the following manner:

- Conduct an evaluation of industry requirements and the necessary level of aids to navigation resources to satisfy those requirements.

- Obtain better portable sounding equipment to perform high speed, low cost channel surveys for the effective placement of buoys.
- Institute better coordination and cooperation with the Corps of Engineers at the working level to place or replace navigation and/or hazardous channel condition aids.
- Obtain better user input to determine the areas and types of hazards causing frequent commercial and recreational accidents.
- Provide greater experience levels and stability of "aids-to-navigation" personnel through lengthened tours of duty and prerequisite assignments. This appears to be the most necessary policy change.

RECOMMENDATION 4. To reduce potential hazards to navigation the USCG should take the following actions:



There is a need to determine the effects of bridges on commercial navigation safety and operation.

- **Regarding Navigation Hazards**—The USCG should, in cooperation with the COE, undertake an inventory of commercial and recreational navigation hazards in segments of the GREAT II study area with a history of frequent accidents. An action plan should be devised for eliminating hazards or protecting water traffic from them. Political, legal and administrative actions should be specified as well as technical

requirements. While this plan is being developed, there are other steps (see the following) which can be implemented immediately that would reduce hazards to navigation.

Studies should also be made to determine the need for improved lighting methods for night barge operations, to insure maximum safety for recreational boaters.

- **Regarding Enforcement of Operating Regulations**—Compliance with bridge regulations is imperative to insure safe passage. Operating regulations must be vigorously enforced by the U.S. Coast Guard. To accomplish this, the Acts of 18 August 1864 and 3 March 1899, the Bridge Act of 1906, and the General Act of 1946, should be amended to provide for civil penalties in certain circumstances and for other purposes as recommended by the USCG.

Specifically, the USCG should modify the existing Bridge-to-Bridge Radio Telephone Regulations to require the use of radio telephone calls in blind situations.

- **Regarding Obstructive Bridges**—The USCG should conduct a study to forecast the magnitude and nature of rail and vehicle bridge traffic over Mississippi River operating-type bridges and quantify its effect on safety and operation of commercial vessel navigation. This study should include an evaluation of the utilization of existing bridges by land traffics and the impacts of bridge removal on land traffics. Recommendations regarding removal of under-utilized bridges could then be made.

Where new bridges are proposed, through the Truman Hobbs Act, or otherwise, the USCG should develop guidelines for assessing the impacts on navigation. The parameters to be considered should include span, location and orientation of the bridge with respect to channel contours and width and current patterns. Moveable bridge and bridges at bends should be avoided if at all possible. Present water traffic density and the range of tow dimensions should be considered. Expected developments in the number and sizes of tows and in the types of cargo carried should be taken into account. The Truman Hobbs Act should be amended in order to better implement the above measures. These amendments would be:

- To include replacement or repair of bridge protection systems.
- To include benefits to land as well as marine interests. Because public money is being spent, the total public benefit should be considered in benefit/cost ratios.
- **Regarding Detectability of Bridges**—Plans to replace or rebuild bridges are costly and time-consuming. While these plans are being developed the USCG can reduce navigation hazards by immediately improving: 1) the detectability of bridge piers through the use of radar transponders, conical reflectors or marking with reflective tape and, 2) the aids to navigation on approaches to bridges. An innovative system is needed which allows pilots to line up and maintain alignment with greater accuracy, especially where the bridge approach includes a bend.



The Aids to Navigation System at bridges need to be improved to reduce safety hazards.

RECOMMENDATION 5. Each transportation mode has unique advantages and disadvantages. The public interest will best be served by focusing public policy on the development of an efficient inter-modal transportation system.

The State and Federal DOT's should develop policies which focus on and promote

inter-modal transportation systems. In developing specific implementable plans, the impacts of these plans on each transportation mode, as well as the total system should be analyzed. Specifically, these agencies should:

- Coordinate federal, state, local, and private interests to maintain and improve rail service to key port areas.
- Insure sufficient highway load and volume capacity to key port areas.
- Research inland port development including analytical support, development of technical criteria and guidance, and monitoring and documenting port activities.
- Develop better cooperation between states for common waters where area wide port facilities are needed.
- Encourage development of local comprehensive transportation plans.

RECOMMENDATION 6. Industry attempts to comply with permitting procedures in order to acquire a permit for fleet facilities and/or river development are often time-consuming, costly and frustrating.

State and Federal agencies concerned with permitting of fleet facilities and river development should streamline, where applicable, their permitting procedures by instituting the following procedures (all criteria and procedures in recommendation may not be applicable to both State and Federal governments):

- Establish time limits in which comments may be received or project reviews conducted.
- Coordinate responses between various agencies or departments within a state.
- Establish more precise evaluation guidelines for environmental analyses so that project assessments can be accomplished at a reasonable cost and in a timely fashion.
- Require documentation supporting objections or concerns expressed by agencies or individuals.
- Investigate issuance of general permits for minor and similar activities.

These procedures are not intended to bypass the environmental review process and/or to negate the final approval power of the land management agency.

RECOMMENDATION 7. To date, adequate studies to identify the primary, secondary, and cumulative impacts of barge fleeing have not been undertaken to aid in siting of fleeing areas.

The RID/COE in order to meet anticipated fleeing requirements should undertake studies in coordination with the state and federal resource agencies to assess the environmental and economic impacts of barge fleeing on the UMR.

These studies should be used to identify fleeing sites and measures which will protect fish and wildlife resources.

They should include tree damage, backwater mooring, required dredging, conflicts with other uses, turbidity, shoreline erosion effects on endangered species, introduction and resuspension of sediments and the total ecosystem.



The primary, secondary and cumulative impacts of barge fleeing areas need to be addressed.

CHANNEL MAINTENANCE



RECOMMENDATION 8. RID/COE and agencies participating on the OSIT should take action immediately to implement the plans and programs contained in the GREAT II Channel Maintenance Handbook. (See supplement to this Report).

COMMERCIAL/ INDUSTRIAL/ UTILITY



RECOMMENDATION 9. The GREAT II studies addressed the commercial /industrial/utility component only briefly through a contract to "identify the problems and needs of commercial river use." A report was prepared by the contractor and recommendations were made. A number of the recommendations in the report have already been made by other work groups (i.e., CTWG and RWG). However, the overall need, a lack of complete, accurate data, or consolidation of existing data, regarding economic use of the UMR corridor, has not been addressed.

There is a need to document economic development problems. In compiling sources for the report, the contractor observed that little information was available on certain subjects. In order to do an accurate analysis of the commercial/industrial/utility needs of the UMR corridor, state and federal agencies should, in cooperation with each other, initiate a program which would include the following studies:

- Development studies that show the interrelated economic impacts (benefits and costs) that all industries located in the study area have on the general economy, especially as they relate to all modes of transportation..
- Detailed studies that assess prime waterway related industries to determine those that are attractive to selected communities.
- Detailed analysis of the development needs and requirements for these industries.
- A study to determine the relationship of all land uses in the UMR to industrial development, and the problems and the needs that result from this relationship.
- A study to determine the potential for hydropower generation within the GREAT II area.

FLOODPLAIN MANAGEMENT



In order to make knowledgeable decisions regarding floodplain management consistent, accurate, up-to-date information must be readily available. All management agencies need to participate in the effort to ensure the availability of this information. Specific areas needing immediate attention are discussed below.

RECOMMENDATION 10. The states of Wisconsin, Iowa, Illinois and Missouri should coordinate to develop consistent management and use of the Mississippi River floodplain compatible with the recommendations of GREAT II.

RECOMMENDATION 11. The RID/COE should seek adequate funding to provide detailed flood boundary/floodway maps of the UMR corridor, based on detailed hydraulic studies, to be used for flood insurance and floodplain management purposes. The mapping effort should be closely coordinated with the math modeling of the flood flows and flood heights of the UMR floodplain for management purposes. (UMRBC Technical Floodplain Management Task Force Report dated August 1978).

RECOMMENDATION 12. The RID/COE should seek funding to examine in coordination with the USDA, USFWS and state management agencies in further detail the products of GREAT I and GREAT II Fish and Wildlife, Side Channel, and Sediment and Erosion Work Groups along with other pertinent information, to determine if:

- sediment accretion in backwaters and subsequent plant succession is affecting flooding.
- floodplain disposal of dredged material is affecting flooding.

This effort should identify all assumptions relative to data manipulation. Upon completion of this review, the COE should publish the results of this review including technical data which either support or refute the contention that backwater sediment accretion and/or floodplain disposal of dredged material is raising flood levels.

RECREATION



According to the GREAT II Recreation Work Groups' Population Projection Report and their Inventory of Facilities, recreational use of the river is expected to increase and additional facilities will be needed. In order to provide a quality recreational experience on the UMR, management agencies will have to put more time and money into recreation management of the UMR and coordination with other management philosophies. The following recommendations identify the agencies and the associated responsibilities necessary to ensure a quality recreational experience.

RECOMMENDATION 13. Late in the GREAT II study process, the COE policy of cancelling recreation lease sites, as per Executive Order 11988, Floodplain Management, became a major item of public concern. GREAT II did not address this problem directly, but felt that the matter required further evaluation. It is therefore recommended that the RID/COE conduct a complete analysis of the policy determination to use such lands for recreation, fish and wildlife or floodplain management purposes. Plans designating the proposed uses of these areas should be developed. The needs analysis and planning process should include citizen representation from both lease holders and non-lease holders in the project area.

This study should be completed as soon as possible and recommendations made relative to the enforcement or modification of Executive Order 11988.

RECOMMENDATION 14. In order to properly manage the UMR for recreation information on the amounts of various types of use, types of facilities available, the use of the various facilities and the distribution of the use is needed. State management agencies can use this information to predict not only the future use of recreation areas but they can better predict the specific types, number and locations of needed facilities.

GREAT II compiled information primarily

on dredged material beach use. In order to compile a complete set of data for all recreational uses of the UMR, the management agencies should:

- Develop a statistically reliable recreation survey for all recreation uses (includes hiking, photography, bird-watching, hunting, fishing and trapping) of the total river corridor and the total use incurred.
- Implement a recreation use monitoring system which includes an update of the existing facility inventory.
- Utilize the existing supply inventory of facilities in conjunction with an inventory of the undeveloped (for recreation) areas to determine the potential locations for facility development.

The collection of this information should be coordinated with other recreational planning efforts, including the UMRBC, UMRCC, USFWS, and COE to ensure comparability of recreation activities.

RECOMMENDATION 15. The Mississippi River has not in the past, been considered in the development of State Comprehensive Outdoor Recreation Plans (SCORP). In order to facilitate satisfactory completion of Recommendation 14, state management agencies should:

- Include the UMR as a SCORP subject.
- Coordinate the activities of the SCORP planners.

RECOMMENDATION 16. Once the information outlined has been collected, the state management agencies (in coordination with the UMRBC, the COE, the USFWS and other appropriate agencies) can begin to address the UMR in more detail. They should begin by evaluating the needs and potentials for all types of recreational use and development for each pool in the GREAT II reach. When these needs have been fully identified, recreation management objectives should be developed for each pool.

RECOMMENDATION 17. A more specific problem along the river has been the lack of adequate access. However, recreational access should not be expanded on recreational demands alone but should consider the other multiple use values of the UMR. To this end an evaluation of alternatives should occur early in

the planning process. Consideration should be given to expanding auto/pedestrian access to recreational areas on the UMR.

Once access needs have been identified the state agencies in coordination with the UMRBC, RID/COE, the USFWS, and other agencies as appropriate, can develop and implement plans for access developments, including purchase of access rights and design of access areas. Established access points should be maintained as needed to minimize new development. Adequate surveys for cultural resources and provisions for mitigation measures for damage to cultural resources should be included in these plans. Properly designed access areas will also decrease the potential for recreational damage to levees and should prevent increased erosion off the access sites.

In order to minimize new development and still provide adequate access, efforts should be made to identify and upgrade those already established access points which, for safe and reliable use, require some physical maintenance or modification (road upkeep, dredging, redesign, etc.).

One area that has been identified is the recreational boat access to Pool 11 located off the dike road at L/D 11. The RID COE should extend the rock riprap spit to protect the access ramp from wave action.

Pool 19 should be considered a high priority for study of recreational access needs and alternatives.

RECOMMENDATION 18. In the development of management plans for each pool, state and federal management agencies should identify procedures and develop plans designed to promote a "take it home" campaign and thereby decrease litter problems. These plans could include:

- Increased enforcement of litter laws on peak use occasions.
- Organization of litter pickups through local community groups.
- Development of container deposit laws.

RECOMMENDATION 19. The management plans in recommendation 16 should also give the state management agencies an indication of the need for trail development along the UMR. Efforts to expand the existing trail system should be coordinated with the Great River

Road Program. The trail system should include canoe trails in backwaters and multi-purpose trails on land. In addition, those abandoned railroad right-of-ways along the river which meet the agencies' criteria for trail development should be maintained for recreational trail use. However, before conversion, railroad rights-of-way should be fully evaluated for future transportation need. Recreation developments should be compatible with natural and cultural resource objectives.



Abandoned rail beds have potential for future multi-use trails.

RECOMMENDATION 20. Noise levels of boating equipment used on the UMR vary greatly depending on an individual's intended form of recreation and their personal preferences in types of equipment used. High noise levels often reduce the quality of the recreation experience for those individuals seeking a quiet, relaxing atmosphere. In order to reduce conflicts between various users of the UMR, state regulatory agencies should require manufacturers to reduce noise levels on new engines. In addition the state agencies should encourage legislation on equipment operation and provide for the enforcement of this legislation.

RECOMMENDATION 21. In order to insure adequate funding for the programs and projects outlined here, all state and federal agencies should seek funding from a combination of all of the following:

- The Federal Government should provide grants and small loans. Small

Business Administration loans and technical assistance to help private businesses to provide recreation opportunities that are available to general public use.

- The Bicentennial Land Heritage Programs should continue to upgrade and expand recreation facilities and continue the program funding.
- Increased Land and Water Conservation Fund (LAWCON) funding and restructuring of cost share ratios are needed.
- State agencies should seek increased State funding for their facilities through general funds, Marine Fuel Tax funds, registration fees and special use taxes.
- The Federal Department of Transportation (DOT) should continue funding of the Great River Road program.
- Increase in Corps of Engineers Recreation Resource funding.
- Local communities should increase locally generated monies for operation and maintenance of recreational facilities.

RECOMMENDATION 22. State and federal agencies responsible for issuing boathouse permits should carefully control and enforce issuance to prevent extended residency, sanitary discharge, aesthetic impacts and conflicts respective to other uses of the river resource.

WATER QUALITY



Due to the large number of state and federal agencies that have management responsibilities for the UMR, there are consequently a large variety of regulations affecting management of the river's resources. Water quality management is no exception. Consequently, there are areas where water quality management programs addressing the UMR need to be improved.

It is hereby recommended that the EPA and states make the following additions and or improvements to their water quality programs as they relate to the UMR:

RECOMMENDATION 23. USEPA in conjunction with interested states should develop new water quality criteria for suspended and deposited sediments. Present water quality criteria for suspended sediments do not reflect the concern over loss or degradation of aquatic habitat caused by suspended and deposited sediments. Since sedimentation appears to be a greater threat to desirable aquatic habitat than diminished primary productivity in the GREAT II area, water quality management would be better served by criteria which protect habitat as well as the photosynthetic process. Water quality criteria relative to dredging should be incorporated into the GREAT II Channel Maintenance Handbook.

RECOMMENDATION 24. The USEPA in conjunction with the USDOT and the states should investigate and complete where necessary additional regulations, which protect the waters of the UMR from potential spills from industrial, municipal, or transportation related transport, transfer, storage and handling of toxic and hazardous materials.

RECOMMENDATION 25. The USEPA in conjunction with appropriate federal agencies should require all industries located in the floodplain, which produce or store toxic materials, to be floodproofed, to the standard project flood. Prior to implementation a benefit cost analysis of those regulations should be conducted. The program should be prioritized according to the type of materials produced, stored or handled.

RECOMMENDATION 26. The USEPA or delegated state agency should require all NPDES permit holders who must file quarterly thermal monitoring reports in the GREAT II study area, to submit these reports in identical format. These NPDES permit holders should use a mathematical model of the heat dispersion of their effluent in the Mississippi River. The model should be able to predict the following characteristics of the thermal plume:

- Length, width and depth of the 5° F over ambient thermal plume.
- The percent of the river cross-section passing through the 5° F over ambient plume.
- The percent of the river flow passing through the 5° F over ambient plume.

The USEPA should evaluate those areas identified as being affected by overlapping plumes for the cumulative impacts of thermal pollution.

RECOMMENDATION 27. Studies conducted by the WQWG have shown that the existing network of water quality monitoring stations is not adequate to assess the impacts of a large urban area on the UMR. The USEPA in conjunction with the USGS should establish a cluster of water quality monitoring stations below a major urban area within the GREAT II study segment (Quad Cities is recommended). This group of stations will be used to measure the impact of the discharges (including stormwater) of a large urban area, on water quality in the Mississippi River. Such a study would be useful for establishing techniques to determine need areas on the UMR for any wasteload allocation projects.



There is a need to improve water quality monitoring below large urban areas in the river system.

Study design should provide for at least four stations that will show the rate and spatial extent of the recovery and/or dispersion process. Water quality variables to be monitored should include, as a minimum: temperature, pH, conductivity, DO, BOD, COD, NH₄-N, NO₂ + N, NO₃-N, Total P, total filterable P, FC, turbidity, suspended solids, the total and dissolved fractions of metals: iron, manganese, cadmium, chromium, copper, lead, zinc and mercury.

RECOMMENDATION 28. The state selection process for priority funding of public wastewater treatment systems should include a weighting factor for recreation and fish and wildlife benefits of the proposed project.

RECOMMENDATION 29. The States of Wisconsin, Iowa, Illinois and Missouri, with the assistance of USEPA, should implement industrial waste pretreatment and resource recovery programs as soon as possible.

Pretreatment programs should consider the industrial discharges to the municipal sewage systems of these cities as their first priority:

- Dubuque, Iowa
- Clinton, Iowa
- East Moline, Moline and Rock Island, Illinois
- Bettendorf and Davenport, Iowa
- Muscatine, Iowa
- Burlington, Iowa
- Fort Madison, Iowa
- Keokuk, Iowa
- Quincy, Illinois

There are 15 known industries whose discharges have been shown to contain significant pollutants (see list in WQWG appendix).

Where possible, more effective waste treatment and/or resource recovery should be accomplished with priority on known industrial discharges to the Mississippi.

RECOMMENDATION 30. The state water quality management agencies should coordinate to monitor the water quality for fecal coliform bacteria at major recreation areas where body contact recreation activities occur.



Improved water quality monitoring at body-contact recreation areas is needed.

RECOMMENDATION 31. There are few facilities along the UMR where recreationists can pump-out their holding tanks. Con-

sequently, the contents of the holding tanks may be put directly into the river. As the number of recreationists increases, the potential for water quality problems also increases.

State and Federal agencies should assess the need for additional pump-out facilities and the feasibility of declaring sections of the UMR as "no discharge areas."

Agencies should promote cost sharing of state and federal monies with county and municipally operated marinas for sanitary pump-out facilities. Urban areas and privately operated marinas should be required to provide sanitary pump-outs with the help of low-interest loans. In addition, permittees and leasees along the UMR should be required to install sewage treatment or pump-out facilities.

RECOMMENDATION 32. Each bank of the UMR is lined with railroad tracks. Freight trains in the study area carry numerous cargos of toxic and hazardous materials. An accidental spill of any of these materials could have devastating impacts on water quality and consequently, fish and wildlife resources.

The Federal Railroad Administration should recognize the potentially serious environmental impact of a rail accident involving hazardous materials on railroad lines bordering the UMR, and should place a high priority on safety enforcement efforts on these lines.

The FRA should take any steps necessary to assure that information about required responses to spills and other accidents is readily available to the railroads.

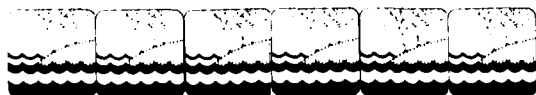
RECOMMENDATION 33. The President's Council on Environmental Quality has established a National Oil and Hazardous Substance Pollution Contingency Plan. As a part of this plan a Regional Response Team (RRT) was formed for the North Central Region. This RRT is responsible for responding to all pollution emergencies in the GREAT II study area. The RRT is chaired by USEPA. Its members consist of federal agencies and state liaisons. The RRT is to provide for efficient, coordinated and effective action to minimize damage from oil and hazardous substances discharges, including containment, dispersal and removal.

The USFWS represents fish and wildlife

resources on the RRT. In many cases the chemical composition and source of a hazardous spill is unknown and mortality of organisms is the only indicator of a spill. A quick response of the RRT could avert a natural disaster on the UMR. The RRT's collection of biological and water quality samples could be facilitated by establishment of a contingency plan for each of the pools of the UMR. This plan would ensure necessary equipment (booms, staging areas, collection bottles, etc.) and trained personnel would be available in each pool for quick response to any spill. Cost of cleanup and/or mitigation should be paid for by the handler or carrier responsible as required by law.

Contingency plans providing a quick response to toxic spills as required by law for the protection of fish and wildlife resources should be developed for each pool. These plans should be coordinated by the USFWS in conjunction with state resource agencies and the Regional Pollution Response Team.

SEDIMENT AND EROSION CONTROL



As discussed in Chapter 2 the major source of sediment in the UMR originates from upland erosion. In rural areas, improper agricultural practices increase the potential for erosion and consequently, sedimentation. Sedimentation was also discussed in the Channel Maintenance Component as it related to dredging. Erosion and sedimentation however, must be considered on a broader scale. Erosion reduces the value of croplands and the amount of good topsoil. Erosion reduces the life of recreational areas and may result in loss of valuable cultural resources. Sediment fills in backwaters, creates turbid water conditions and affects growth and spawning of fish. To deal with these problems effectively, they must be managed first, at the source.

RECOMMENDATION 34. Accelerated land treatment is needed on 9.5 million acres of

cropland to reduce erosion to tolerable levels at which soils will maintain themselves. This will protect and preserve the soil resource base and reduce a potential source of sediment to the UMR. It will also decrease the amount of suspended sediment delivered to the UMR corridor (see page 33).

The USDA and other appropriate state and federal agencies should be funded to provide additional technical assistance and cost sharing to agricultural landowners. Adequate programs exist if the funding can be provided.

RECOMMENDATION 35. Another source of sediment in the UMR is from the tributaries themselves. Additional gaging stations are needed to gather data on suspended sediment, bed material and bed loads, for ungaged tributaries to the UMR.

The USGS should install gages on the following selected tributaries where data indicate a need for erosion protection:

RECOMMENDED GAGING STATIONS

WATERWAY	LOCATION
Turkey River	Garber, Iowa
Grant River	Potosi, Wisconsin
Maquoketa River	Monmouth, Iowa
Rock River	Joslin, Illinois
Green River	Geneseo, Illinois
Iowa River	Wapello, Iowa
Skunk River	Augusta, Iowa
Des Moines River	St. Francisville, Missouri
Fabias River	Monticello, Missouri
Main Stem at Locks Dams 13, 16, 20	Locks and Dams 13, 16, 20
Galena River	Galena, Illinois
Apple River	Hanover, Illinois
Crow Creek	Bettendorf, Iowa

These gages should be maintained for a period long enough to provide a statistically accurate record at each site. These data should be used to develop a sediment transport capacity model to correlate surface erosion rates with carrying capacity, rate those watersheds with the most serious problems and develop a treatment program if a solution is necessary.

RECOMMENDATION 36. Streambank erosion is another potential source of sediment in the UMR. The COE should, in conjunction with other federal (Soil Conservation Service) and state management agencies, conduct a study of streambank erosion on the main stem and tributaries of the UMR. This study should identify sources and volumes of sand-sized material generated in erosion and estimated to be delivered to the Main Stem of the UMR. These data would be used in future sediment budget studies. Where problem areas are identified, a treatment program should be developed and implemented.

The study conducted by the COE should also identify eroding areas affecting recreation and cultural resource sites and develop plans to reduce these damages.

RECOMMENDATION 37. A sediment budget study contracted to the University of Iowa, Institute of Hydraulic Research by the GREAT II Sediment and Erosion Control Work Group concluded that detailed cross-section surveys of the Mississippi River are required so that variations of sediment balance in each pool can be monitored. The data collected would allow hydrologic analysis of individual dredging problem and backwater accretion sites, and would provide the basis for more comprehensive sediment budget analyses. RID/COE should, therefore, conduct detailed pool-by-pool cross-section surveys, including off channel areas on an annual basis and provide analyses to the CARS, FWIC and OSIT. Based on analyses of these data, the FWIC should develop and implement a program for rehabilitation of critical backwater areas. Data should also be published in order to make this material available to researchers doing work on basic hydrologic and morphologic problems.

RECOMMENDATION 38. Boat harbors and recreational access areas suffer from severe sedimentation in some cases. These areas would be partially helped by the implementation of the above recommendations. The RID/COE should identify those harbors and access areas which are poorly designed or improperly located and develop a plan for the rehabilitation or relocation of these areas. Funding should be provided by the responsible agency or agencies.

FISH AND WILDLIFE COMPONENT



RECOMMENDATION 39. As the GREAT recommendations regarding dredging and main channel modifications are implemented, frequent consultation will be needed on fish and wildlife resources. A specific coordinating team will be needed to respond quickly in providing direction as to which course of action will protect fish and wildlife resources. This will minimize delays when responsive direction and consultations are needed. In addition, there will be a continuing need for coordination of broad scope river management studies and investigations. Such an inter-agency group will be critical in developing and facilitating research too comprehensive for any one agency to handle.

A Fish and Wildlife Interagency Committee (FWIC) should be designated and funded to provide coordination regarding fish and wildlife matters associated with main channel dredging, dredged material disposal, physical river modifications, backwater modifications, and river management studies and investigations. The FWIC should be composed of fish and wildlife biologists from Wisconsin, Iowa, Illinois, Missouri, USFWS and COE. Initially this committee will be chaired by USFWS. Member agencies should provide funds necessary for their participation.

Specific areas where the FWIC should provide such coordination are to:

- Define fish and wildlife management objectives.
- Develop and recommend a comprehensive fish and wildlife management plan for the entire GREAT II reach (based on above objectives).
- Consider the development of a fish and wildlife management plan for Pool 19 as highest priority (see Fish and Wildlife Discussion, Chapter 2).
- Ensure compatibility of all FWIC activities with those of the UMRBC in the development of UMR resource management plans to avoid duplication of efforts in the collection or dissemination of data (see Recommendations 52 and 53).

- Analyze any proposed introductions of organisms not native to the UMR corridor to determine compatibility with the integrity of the native communities before they are introduced. An agreement between agencies should be established through the UMRCC for providing direction for new species introductions. Suitability for continued use of already established exotic species should be determined, and a restrictive list should be created for those found not desirable.

The FWIC will also coordinate and develop recommendations regarding the operation and maintenance of the navigation channel. This function is specifically addressed in the *Channel Maintenance Handbook*.



Improved channel maintenance practices will aid fish and wildlife.

RECOMMENDATION 40. A considerable wealth of information is available on the distribution, abundance, population characteristics, and harvest of many fish and wildlife resources of the Upper Mississippi River. The value of much of that information for use in modern management decision making processes is greatly limited, however, for various reasons. With an ever-changing river environment, information previously collected on the distribution, abundance, population characteristics, and harvest of fish and wildlife resources may not be applicable to present conditions. Much of the information available concentrates on a relatively few species of significant sport or commercial value. Nearly all of the information is collected for specific sites or areas. The ability to integrate information and apply it to the biological system as a whole is severely limited by incongruities in sampling methods or data

analysis, and the intermittent nature and seasonal differences in data collection.

To acquire the needed biological information base for current management planning and decisions, the following studies are recommended to be completed by the USFWS in cooperation with the other state and federal natural resource management agencies:

- Collection of information on the distribution, abundance, population characteristics, and harvest of all fish and wildlife species in the UMR, on a systematic basis.
- A program to monitor federal and state endangered or threatened species to obtain information on abundance and population characteristics. Particular emphasis should be placed on present habitat utilization within the UMR floodplain so that habitat management techniques may be developed for the species.
- Monitor the nesting sites of colonial nesting birds. New sites should be located and mapped.



More information is needed about colonial birds nesting sites.

- Develop and implement a plan to inventory the submergent characteristics of the UMR. The plan should consist in part of the pilot plan developed for the FWMWG. However, new technologies must also be investigated to make the inventory economically feasible and easy to update.

Much of the above studies when completed, in addition to existing information, will provide site specific data. Considering the size of the UMR corridor, a bookkeeping system

for storage and immediate retrieval of collected data becomes necessary for management purposes. One available system in the Geographic Information System (GIS) which is being used for long-range planning on the Upper Mississippi River Wild Life and Fish Refuge. Therefore, the USFWS should expand and complete the GIS for the entire UMR corridor and should keep it current as new data is collected. The GIS should be available to all natural resource management agencies.

RECOMMENDATION 41. Several studies on the UMR need to be completed to adequately address various aspects of habitat enhancement through backwater modifications. The RID/COE should complete the following investigations in coordination with the FWIC:

- Initiate a pilot project to determine the feasibility and environmental considerations for dredging a backwater area.
- Use in-house capability, if available, to apply the physical, chemical and biological data from Burnt Pocket, Fountain City Bay, and any other side channel alteration studies to other computer models or methodologies to further test and refine the capability to predict the biological consequences of physical alterations to side channels and backwaters.
- The feasibility of using fine sediments for agricultural purposes in the GREAT II area should be investigated. Potential dredging of the backwaters will require the disposal of significant amounts of silty materials.
- Unless agricultural disposal is shown to be feasible, it is likely most disposal would occur in areas of basically monotypic lowland hardwood habitat.

Unlike dredged sand, it is thought that dredged silt may provide opportunities for enhancing lowland hardwood habitat. The RID/COE and the USFWS in cooperation with the Illinois Department of Conservation and the U.S. Soil Conservation Service have developed a plan to evaluate habitat development on silt in conjunction with the Fulton Local Flood Protection Project. This plan will evaluate silt tolerance and growing



Information needs to be gathered on the effects of vegetation of various depths of dredge material disposal.

success of tree, shrub, vine and grass species that are beneficial to wildlife. Additional information will be sought to determine the relative effect of varying disposal depths on vegetative survival. Effects on cultural resources must also be considered.

Desorption of pollutants from dredged silts and muds is a definite possibility. A water quality monitoring program should be initiated with any demonstrations, or addressed in any feasibility studies. It is possible that complete containment of the dredged material and water may be required, which may affect habitat development.

The RID/COE should complete the dredging and habitat development project and monitoring program described in the Technical Report for the Fulton Local Flood Protection Project Stage IIIC.

- Based on the information obtained above as well as that gathered in conjunction with various side channel opening or closure projects (FWWG-GREAT I, SCWG-GREAT II), the RID/COE should complete the priority 1B backwater alterations as prioritized by the SCWG, (see Criteria for the Determination of Appropriate Action in Priority 1 Backwaters—Section II.D.—SCWG Appendix). The RID/COE should coordinate these alterations with the FWIC to ensure maximum benefit to fish and wildlife resources.

SCWG PRIORITY 1B SITES

Sites which have lost considerable value to "natural" causes. These sites will continue to lose habitat value at a rapid rate. Remedial action is required immediately if the area is to be preserved.

POOL	SITE	RIVER MILE
11	Ackerman's Cut	613.9L
	Goetz Island Side Channel	614.5R
	Jack Oak Slough	605.9L
	Bertom Lake	602.5L
	Unnamed	599.5L
12	Stump Island	582.0L
	Industrial Chemical Light	578.0-579.0L
	Harris Slough	564.0-566.0L
13	Lainsville Slough	545.8R
	Brown's Lake Complex	544-546R
	Pin Oak Lake	541.9R
	Spring Lake Levee	531-534L
14	Sunfish/Cattail Slough	516-518L
15	No Sites in Priority 1B	
16	Andalusia Island	463.5-466.5L
	Dead Slough	461.5-464.0L
	Wyoming Slough	458-461.0R
	Drury Slough	459-461L
17	Blanchard Island	449L
18	Sturgeon or Boston Bay	433-434L
	Unnamed	429.2-430.8R
	Blackhawk Island	427R
	Kingston Bar	424R
	Campbell Island	419.5-423.3L
19	Otter Slough	407-409R
	Unnamed	394.5R
	Grape Island	391R
20	Taylor Chute	353L
	Huff Hunt Islands	349-350L
21	Bear Creek Recreation Area	341.0L
	Long Island	333.5L
	Teal Island	332.5L
	Triangle Lake	330L
	Broad Lake/Quincy Bay	328.0-329.2L
	Monkey Chute	325.0R
22	Texas Chute	324.0L
	Beebe Island	316.7-318.5L
	Unnamed	316.0L

(Note: The SCWG also identified backwaters in need of alteration that have been impacted by construction, operation and maintenance of the navigation channel. This recommendation is in the Channel Maintenance Handbook.)

- Initiate a research and development program in conjunction with the COE, to determine the equipment (pieces of equipment or equipment system) necessary for performing large scale backwater alterations.

RECOMMENDATION 42. The RID/COE in conjunction with the FWIC should develop and scope a study to determine the cumulative effects of increased industrial, municipal, residential and recreational encroachment on fish and wildlife habitat and the effect of environmental regulations on industrial, municipal, residential and recreational development in the UMR corridor. The results of such a study will aid permitting agencies in making permitting decisions.

RECOMMENDATION 43. Although there are many studies which could be identified for support, based on the significance of the completion of these studies to protecting fish and wildlife resources, the following studies should be completed and the collection of information coordinated with the ORRMT:

1. The UMRBC Master Plan study has outlined and initiated studies to address future environmental management needs/concerns on the UMR. It is questionable, due to time and funding constraints, that these studies will be completed. The results of the Master Plan should be coordinated with FWIC and these studies completed as necessary.

- Address the impacts of commercial and recreational navigation on the fish and wildlife resources of the UMR.
- Identify measures that can be used for mitigation, restoration, protection, management and enhancement of environmental resources.
- Determine the adverse and beneficial impacts of each measure identified with respect to:
 - the environment
 - national and regional economies, and
 - the social character of the region.
- Determine which of those measures identified can be immediately implemented.
- Determine costs and studies for those measures identified which will require demonstration projects to evaluate adverse and beneficial impacts.

2. RID/COE should complete the winter biological studies recommended in their feasibility report on year-round navigation.
3. Coordinated refuge master planning effort on Upper Mississippi Wild Life and Fish Refuge.

CULTURAL AND AESTHETIC



RECOMMENDATION 44. There is evidence that our natural heritage is being lost as a result of changing land uses without proper controls or protections. The components of our natural heritage, that is fragile natural, scenic and cultural areas, must first be identified in order that they may be protected for future generations.

Approximately 25 states have initiated a program to identify, locate and make protection plans for remaining natural areas (i.e., areas which still demonstrate an undisturbed nature reminiscent of their condition at the time of settlement). Many of the 25 states are cooperating with the Nature Conservancy in establishment of a "Heritage Program" in their state.

The state management agencies, the RID/COE and the USFWS, should develop and complete a natural history survey to identify those natural, scenic and cultural areas needing protection. When this survey has been completed the state agencies should use the information collected to prepare natural and cultural area base plans. The plans should include a system to protect from loss those areas identified in the natural history survey. The plans should also include guidelines to establish control entities in areas where none exist. State management agencies should observe the criteria for funding of natural history surveys, as set forth in the Heritage Conservation and Recreation Service Manual "Guidelines for Planning Assistance".

RECOMMENDATION 45. Industrial/commercial development in the form of unlimited strip development, can adversely impact the aesthetics and natural habitat value of the river corridor. Industrial development (as carried out per Executive Orders 11988 and 11990) in the form of commercial terminal complexes should be encouraged through tax incentives or through municipal comprehensive planning as a means to limit strip development. In order to protect the aesthetic quality of the river and at the same time establish greater efficiency in industrial development, all levels of government should encourage consolidation into terminal complexes during local plan formulation prior to requests for permits.

RECOMMENDATION 46. Adequate management of cultural resources on federal lands is severely constrained by the lack of locational data. The identification of such resources, nomination of significant cultural properties to the National Register of Historic Places, and management of the cultural resources is required by EO-11593, Public Law 89-665, and implementing regulations of the involved federal agencies.

The RID/COE and the USFWS own and/or manage the majority of the federal lands in the GREAT II study area. In order to assure proper protection of cultural resources in the GREAT II area and to measure and lessen these losses and preserve important examples of these nonrenewable resources for future generations, the RID/COE in coordination with the USFWS, should develop and implement a systematic survey to locate and identify cultural resources in the GREAT II reach of the UMR. This task should be accomplished in coordination with the HCRS and SHPO's.

The survey should incorporate, at a minimum, the following activities:

- Conducting geomorphic studies of present land surface and literature and document search of preinundation landscape to determine likely areas of location of buried archaeological sites.
- Conducting UMR bank surveys to locate and identify unknown archaeological sites which are being affected by wave action.

- Conducting a thorough historical records search and evaluation to identify location of known steamboat wrecks.
- Expansion of their administrative policy on removal of sunken wrecks and obstructions. Where such wrecks are an obstacle to navigation, their removal should be an alternative (i.e., where the wreck is located in either the main channel and/or other commercially navigable waters).
- Conducting a historic architectural/engineering survey of as-built navigation system structures as a significant historic network.

RECOMMENDATION 47. The perception of 33 CFR 305 (the implementing regulations of the COE for identification and administration of cultural resources) by SHPO's and state preservation program staff is that sections of the regulations are vague and their application varies between COE districts.

In order to increase the accuracy and consistency of the application of this regulation among the staff which work with the regulations on a daily basis, the NCD/COE should conduct regular workshops at the Division level for district staffs and state preservation program staff. The programs should include definitions and interpretations of 33CFR 305 as well as the problems that have resulted to date in compliance with the regulation. The CRWG appendix documents 15 sites in the GREAT II area where application of the law could be improved.

RECOMMENDATION 48. Other than private land owners, local governments maintain control over the majority of public lands within urban areas and corporate limits of municipalities. Contained on and within these public lands are potentially many non-renewable resources including archaeological sites, as well as standing structures of architectural and historical interest.

The HCRS and the preservation programs of the involved states should work more closely and intensively with local governments to develop local ordinances which, will, at a minimum, consider the preservation and conservation aspects of the built environment prior to development.

PUBLIC INFORMATION AND EDUCATION PROGRAM



RECOMMENDATION 49. There is a need to provide public information that will increase public knowledge and understanding of the UMR resource; and its problems, opportunities, benefits and hazards. Improving public understanding and education will aid state agencies in managing the river through increased cooperation, and will help to reduce the dangers to the public associated with use of the UMR. Many GREAT II work groups recommended initiation of a public education and information program for their areas of study.

State management agencies presently have public education and information programs. However, development of information for the public about the UMR has been limited.



A comprehensive public information and education program about the river system needs to be developed.

The state and federal management agencies of the GREAT II area should fund the development and implementation of a comprehensive public education and information program. The goals of this program would be:

1. To explain concepts of land use management as a viable tool for conservation and preservation of UMR resources.
2. To provide a centralized, independent public information and education program about the UMR and UMR on-going activities.

3. To increase awareness and understanding of the UMR through:

- Development and distribution of signage, programs and literature on the opportunities and facilities of the UMR especially as it relates to recreation and navigation.
- Development and distribution of signage, programs and literature promoting the value of the resources of the UMR, and the need for wise management of these resources, especially as it relates to fish and wildlife resources, cultural resources, water quality, dredged material and soil conservation measures.
- Development and distribution of signage, programs and literature describing the management programs of the UMR, especially as it relates to floodplain management and development.
- Development of public education programs on safety and litter (including mandatory safety/operation education procedures for boat rental companies).
- Development of programs to identify hazards, mark channel control structures where suitable to allow safe passage of recreational craft, and establish no-wake areas in high density use areas.

RECOMMENDATION 50. The GREAT II PPIWG, upon completion of the GREAT II public participation and information program, evaluated the program to determine how future public participation and information programs by federal and state agencies could be improved. Based on that evaluation, the following guidelines are suggested (source GREAT II PPIWG Final Appendix, Chapter III, Pages 103-110):

1. In future studies, the public problem identification process should be included as part of the Plan of Study development phase. Extensive efforts should be made to identify and invite the affected public in this effort.
2. In future studies of large scope and covering a large geographic area, the establishment of a well balanced small citizen group should be considered. Critical to the success of the effectiveness of the group are the following:

- A consistent well documented on-going process for informing and obtaining responses of such a group should be built into the overall study process beginning with the earliest stage of the study.
 - Sufficient funds from the study budget should be allocated to provide staff support, material reproduction costs, etc., for the group.
 - The overall study process should be designed to provide adequate time for the group to thoroughly review and comment on materials — especially those materials directly affecting study decisions — before the decisions are actually made.
3. For studies of large scope, long duration and covering large geographic areas, general informational public meetings should not be used except at critical points, alternate less expensive and more effective means, such as newsletters, media releases, and personal letters are more effective.
 4. In nearly all technical studies where the amount and complexity of information is extensive, the study sponsors should explore the use of one or more intensive workshop-type sessions for interested public interests. Based on an analysis of the GREAT I and GREAT II experiences, the following guidelines should be used in workshop development:
 - The workshop should be scheduled into the overall study process in some cases as a substitute for critical point public meetings. The optimum times for workshops are (1) upon completion of the Plan of Study, (2) just prior to the formal public review process for major draft products.
 - Essential to the success of a workshop experience is the development of good audio-visual materials for use at the workshop. Clear, concise summaries of information to be discussed (narrated slide shows are particularly effective) should be developed by study staff.
 - Study members should be fully briefed in advance of the intent of the workshop, their roles, the information to be covered, and the format to be used.
 - Psychological aspects of the workshop should not be overlooked. Maximum retention of data and promotion of

dialogue can be achieved by holding the workshop in comfortable surroundings that are, at the same time, formal.

- Finally, a person or persons should be assigned to record workshop proceedings to be provided at a later date in visual form to participants or other interested parties. To assure accuracy either a tape recorder or stenographer/court reporter should record the proceedings.
5. To the extent possible every study should have a person or persons available to "go on the road" with information for interest groups, governmental bodies, etc., in the study area. Personal visits with public clientele seems to be the best way to get information out and to gather public attitudes about study items.



An important element in public information programs is the availability of trained people to reach out to the general public.

6. In those cases where a study has a direct impact on local government (i.e., local flood control project) special efforts must be made to work with local government units.
7. An integral part of any study budget should be the funding of a solid public participation and information program with adequate staffing. In the GREAT II Study, 6% of the study budget was allocated to the PPIWG program under contract to a private consultant. Contacts with other PPI staffs in similar studies indicates that an allocation of up to 10% of the budget is usually adequate to carry out an adequate program (not counting the quality and efficiency of the program staff).

8. In future multi-agency studies, consideration should be given to use of independent staff and office facilities, which appears most effective.

RECOMMENDATION 51. Persons or groups attempting to locate available information spend excessive time and money wading through voluminous and unorganized data.

The RID COE should institute a program to arrange and manage the archives of the district.

COORDINATION



Due to time and funding limits, GREAT II did not develop a complete and detailed river resource management plan. The GREAT II recommended plan does provide the framework for continued development of a river management plan. An important element of the GREAT II recommended plan is the identified need for on-going interagency coordination and cooperation.

Many of the recommendations in the GREAT II recommended plan call for on-going coordination as an essential part of the implementation and planning processes. In order to ensure the continuation of this interagency cooperation and coordination (as practiced in GREAT II) and to provide for the long-range planning needs of the Upper Mississippi River System, GREAT II (in coordination with GREAT I) developed an on-going coordination structure.

The following assumptions were used to guide the development of the recommended coordination structure:

- There is a need for continued interagency coordination in all long-range planning efforts of the state and federal agencies.
- There is a need for continued interagency coordination in the implementation of GREAT II recommendations to assure that the interests of all affected parties are considered.
- There is a need for continued sharing of research findings and interagency coordination in the development of

management techniques and information gathering systems.

- The UMRBC has authority to carry out and coordinate on-going planning in the basin, but not implementation of management actions and/or physical changes of the environment.
- The funding and authority for implementation of recommended actions is vested in the states and federal agencies on the basis of their individually mandated state or federal statutes and subsequent department policies, programs, rules and regulations.
- The funding and authority for on-going planning of specific programs is vested in the states and federal agencies on the basis of their individually mandated state or federal statutes and subsequent department policies, programs, rules and regulations.
- There are extensive benefits to be gained through coordination of both on-going planning and studies as well as the implementation of GREAT II recommended actions.

Some actions in the GREAT II recommended plan may be implemented without further study, and require only on-going implementation coordination. Other GREAT II recommended actions require on-going coordination of studies and planning before implementation can occur. The following explains the coordination procedures for each of these situations.

RECOMMENDATION 52. On-Going Planning and Research Coordination.

Congress and the states have recognized the need for regional planning and the coordination of state and federal activities. GREAT studies that indicate a requirement for further study or policy changes must be subject to this regional planning and coordination effort.

The Upper Mississippi River Basin Commission (UMRBC) is presently the mechanism to coordinate planning activities of the UMR.

Therefore, the UMRBC, through the Great River Study Committee (GRSC) should continue to develop a total river resource management plan. Items recommended by GREAT II for further study and policy

changes should be incorporated into the UMRBC planning activities. The GRSC should continue to operate as it presently operates. However, the responsibilities of the GRSC committee should be expanded to provide more intensive coordinating activities. The state or federal agency representative to the GRSC committee, should also serve as the contact/coordination person for inter-departmental communication.

The GRSC should:

- Incorporate results of completed, on-going and future studies (including those recommended as a result of GREAT I, II, III and the Master Plan) into the river management plan.
- Assure adequate public participation in development of the plan.
- Identify and recommend to the UMRBC the need for any new cooperative agreements between the state and federal agencies for consistency in river resource management.
- Assist state and federal agencies in securing new authorities and/or appropriations as necessary, to implement plans as developed.
- Monitor state and federal agency implementation of plans.

RECOMMENDATION 53. On-Going Implementation Coordination

Certain components of the GREAT II recommended plan (i.e., channel maintenance component) contain recommended actions that may be implemented without further study. These actions should be implemented by the lead agency in consultation with other appropriate agencies who would be affected by the actions. To assure that this consultation/coordination occurs there is a need to establish a committee, similar to that of GREAT II, for on-going coordination.

Operating under the Great River Study Committee, the committee could be called the "On-going River Resource Management Team" (ORRMT). The ORRMT should be composed of one representative from each of the participating federal agencies and states. The state of Iowa and the COE should be responsible for initially co-chairing the ORRMT. The co-chairs would be responsible for calling meetings, and maintaining minutes. The offices of the co-chairs would be the

ORRMT headquarters. The ORRMT would meet no less than quarterly. Voting procedures would be the same as those used by the GREAT II Team (see Plan Formulation Technical Appendix.)

The initial and primary responsibility of the ORRMT would be to review the implementation requirements contained in Chapter VI of this report and determine, in more detail, what each agency member must do to begin implementation. On the basis of this review, an annual team plan of action (POA) should be prepared for submittal to each member agency. The POA would identify those actions which should be jointly funded, jointly implemented and/or coordinated.

Each agency should then develop an annual plan of action (beginning with a POA for FY 1982) that outlines specific actions, personnel requirements and funding needs to implement items under their jurisdiction. The POA should also outline how and where the implementable actions fit into existing budgets and programs, or determine if additional resources are required, i.e. funding through the UMRBC/GRSC.

Upon completion of annual POA's, the ORRMT should meet to compare the proposed ORRMT POA to the POA actually adopted by the agencies or states. Items that an agency is unable to complete should be reviewed to determine an appropriate alternative action (for example, inclusion in a subsequent POA, etc.).

As newly identified "action items" are identified by any state or agency as a result of some administrative action or study findings, they should become part of the ORRMT review/coordination procedures. These would include implementable actions recommended as a result of completion of GREAT II, UMRBC master plan and COE and USFWS recreation and refuge master planning activities.

An additional ORRMT duty will be to coordinate with and advise the OSIT as to recommended changes to the RID/COE channel maintenance plan (i.e., primary sites and site selection priorities). The ORRMT recommended changes should be made upon completion of studies recommended in the GREAT II CMP handbook, or as new information and technology becomes available. The recommended changes will be in-

corporated into the annual POA's and simultaneously submitted to the OSIT.

RECOMMENDATION 54. The overall goal of the GREAT studies was development of a total river resource management plan. Improved inter-agency and inter-resource coordination through GREAT has helped approach that goal. However, more information/data are needed to attain such a comprehensive plan.

To help facilitate completion of the plan, the ORRMT, through the member agencies should develop a complete computerized resource information system for all resources and resource uses in the UMR corridor. All data gathered in any resource studies, etc., would be entered (i.e., GIS—see Recommendation 39), into this system. The system would also be continuously updated as new data was made available. The collection of data on land ownership and management is an essential part of this system.

The system would be a valuable tool by having this information readily available to resource managers as they prepare the total river resource management plan.

LEGISLATION



RECOMMENDATION 55. The recommendations which comprise the channel maintenance component of the recommended plan place considerably more responsibility on the RID/COE. In many cases they are not presently authorized to carry out these activities/recommendations. In order to insure that the recommendations developed by GREAT II or by ORRMT in the future can be implemented by the RID/COE, it is hereby recommended that Congress:

Provide the RID/COE with increased funding and authority associated with the UMR 9' navigation project to give equal consideration and to complete measures to benefit Fish and Wildlife and recreation resources. All measures carried out under this authority must be coordinated fully with and agreed to by all agencies having state and federal fish and wildlife resource management responsibilities in the affected area.

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GREAT RIVER ENVIRONMENTAL ACTION TEAM (GREAT II). UPPER MISSISS--ETC(U)

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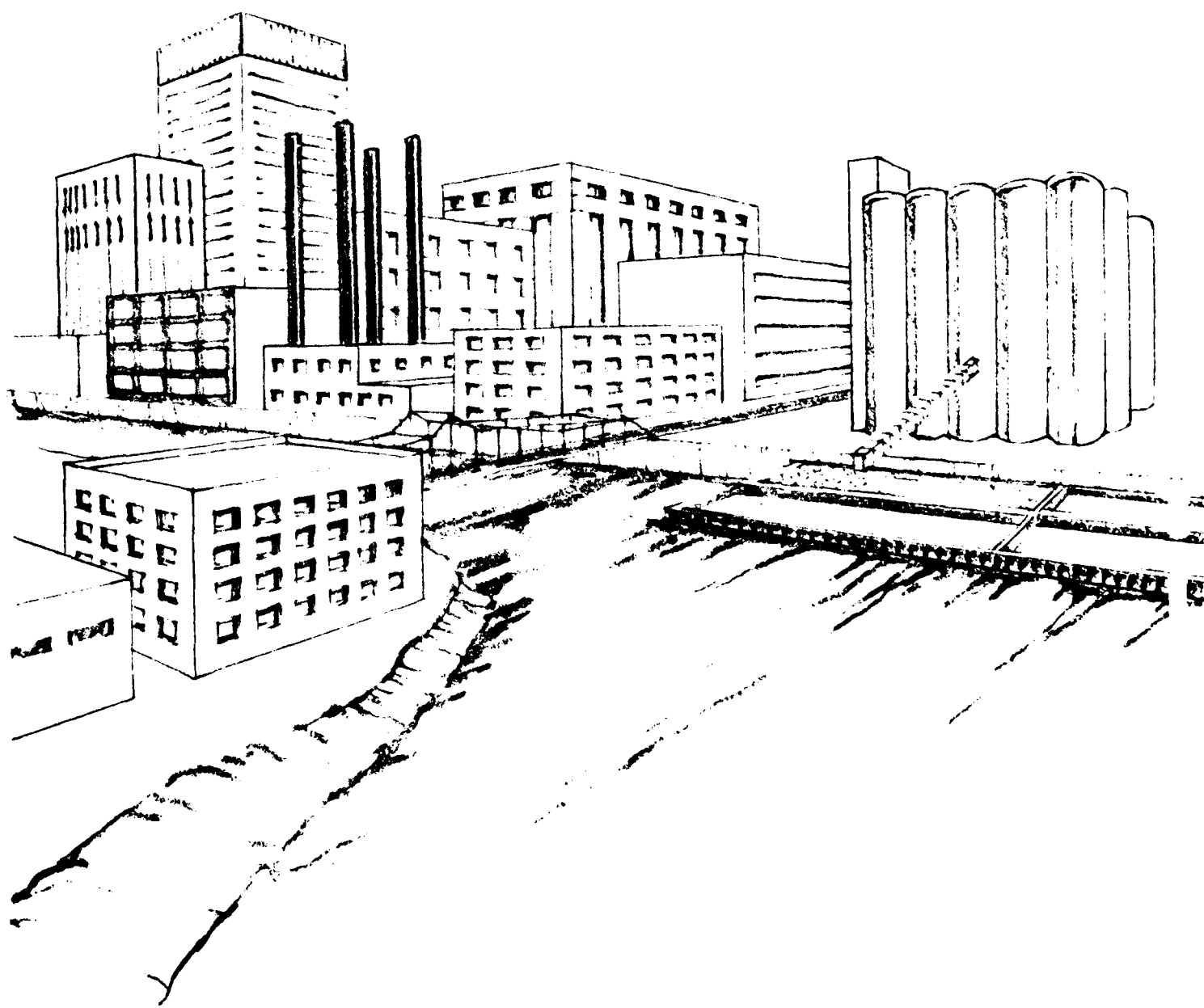
In addition, the RID/COE should be granted the authority to perform alterations to backwater areas for the benefit of fish and wildlife as recommended by the FWIC.

RECOMMENDATION 56. The RID/COE is restricted from developing and maintaining additional recreational areas on Corps lands without a cost sharing partner. Public Law 89-72 should be amended to allow the RID/COE with the approval of affected agencies to develop and maintain recreation areas on Corps general plan lands without local cost sharing. Such action would include the management and maintenance of approved dredged material beaches (selected primary beach disposal sites) and expansion of the existing ranger staff.



ENVIRONMENTAL SUMMARY

chapter 123**4**5



"We also know we cannot forsake our technology, but must find a balance between it and environment. If we can use this tremendous backlog of knowledge toward the preservation of the land instead of its desecration, if we can improve the quality of life, change our priorities, achieve balance and understanding of our role as human beings in a complex world, this coming era may well set the stage for a richer civilization than man has ever known. This is the challenge of the new American frontier."

Sigurd Olson

This chapter summarizes the GREAT II Environmental Report prepared for the GREAT II study and recommended plan. It was prepared in accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969, as amended, as an initial scoping effort. In all cases the GREAT II Team considered the selected and no action alternatives for each recommendation and at times discussed other alternatives to better understand the perspectives of the various participating agencies. Subsequent actions taken by federal, state or local agencies in the implementation of the recommended plan (see Chapter III) will necessitate a more thorough environmental analysis and detailed environmental impact assessment or statement where appropriate, as specified in the GREAT II Environmental Report (Supplement to this report).

The environmental information in the Environmental Report is organized in the same order as Chapter III of this report; by component, and by recommendation within each component. For each component a copy of the

"Display of Accounts" (as displayed in the draft Main Report and draft Plan Formulation Work Group Technical Appendix) is included to give an overview of the proposed actions and the contributions of the proposed actions to the Environmental Quality and National Economic Development Accounts.

The following information is displayed for each recommendation:

- The wording of the recommendation as approved by the Team.
- An Environmental Summary form

The Environmental Summary form summarizes and analyzes all impact information developed by the GREAT II Team, functional work groups and contractors. This analysis was prepared to determine the significance of the environmental impacts of the proposed action, the adequacy of the impact information collected to date and any requirements for additional impact analysis.

The information sources used, in addition to those displayed in the Environmental Report, to develop the Environmental Summary are displayed below:

INFORMATION SOURCE	PREPARED BY	FOR	WHERE INFORMATION SOURCE CAN BE LOCATED
1. Display of Recommendations and Preliminary Impact Assessment Form	Functional Work Groups	Each Work Group Recommendation	GREAT II Work Group Appendixes
2. Impact Assessment Form	Functional Work Groups	Each Work Group Recommendation	GREAT II Work Group Appendixes
3. Impact Assessment Table	Contractor and PREP Task Force	Each Component and PREP Recommendation	GREAT II Draft PWG Technical Appendix
4. Preliminary Evaluation Matrix	Contractor	Each Component and PREP Recommendation	GREAT II Draft PWG Technical Appendix

The impact information contained in the above-cited sources was developed as part of the GREAT II process. This process, is described in Chapter I of this report, and in greater detail in the Plan Formulation Technical Appendix.

The following sections discuss by component, briefly, and in general terms, the types of potential impacts of the proposed actions.

COMMERCIAL TRANSPORTATION

The Commercial Transportation Component proposes actions designed primarily to improve the safety and operating efficiency of existing navigation traffic on the UMR. As safety hazards are reduced, the potential for accidental spills of toxic materials into the UMR is reduced, thereby protecting water quality and aquatic species and their habitat.

Implementation of recommendations that call for structural measures will not be accomplished until additional environmental and economic analyses have been conducted. No impacts are associated with conducting such analyses.

CHANNEL MAINTENANCE

The Channel Maintenance Component focuses on the procedures the RID/COE is to use when disposing of dredged material. These procedures were developed with the primary objective of protecting the environment within constraints imposed by the integration of other concerns; i.e., costs (not presently quantified),

beneficial use of the material, equipment limitations, water quality, floodplain management, and recreation needs into the disposal site selection process. Through the OSIT, and specified procedures, increased environmental protection will occur, while providing the flexibility to allow for new dredged material disposal sites and or procedures as new information and or equipment is made available.

COMMERCIAL/ INDUSTRIAL/UTILITY

The Commercial/Industrial/Utility Component will have no immediate impacts on the environment, as studies are the only proposed action at this time. These studies are designed to determine the means to provide for continued commercial and industrial activity in a manner that will provide protection to the environment.

FLOODPLAIN MANAGEMENT

The Floodplain Management Component deals mainly with the problem of inconsistent floodplain laws, regulations and enforcement programs between state boundaries and agencies. The recommendations are designed to promote greater inter-agency coordination in the development and enforcement of floodplain boundaries and management regulations. No immediate environmental impacts, beneficial or adverse, will occur due to implementation of this component of the recommended plan. However, long-term

benefits to the environment will result through wise and coordinated management of the floodplain.

These benefits will be realized through restricted development in the floodplain and reduced risk of toxic materials entering the waters of the UMR during flooding.

RECREATION

The Recreation Component proposes actions primarily designed to promote recreational use of the UMR.

Where additional facilities are proposed, feasibility studies, including environmental analysis of the proposed actions, must be completed prior to implementation.

Several of the proposed actions may provide long-term benefits to the environment. Establishment of improved anti-littering programs and enforcement of existing littering laws will protect water quality as well as protect the condition of terrestrial resources. Cancellation of cabin site leases, along the UMR, will ultimately result in the growth of wildlife habitat as some of these areas are allowed to return to their natural state.

WATER QUALITY

The Water Quality Component focuses on outlining additional guidance to agencies concerned with water quality management and directs these agencies: to develop new water quality criteria for suspended and deposited sediments, to enforce existing and develop new regulations protecting the waters of the UMR from spills, to develop stricter floodproofing requirements, to standardize thermal monitoring reports, to establish monitoring stations below large urban areas and to establish waste pretreatment programs in designated areas. All recommendations within this component will result in long-term benefits to water quality.

SEDIMENT AND EROSION

The Sediment and Erosion Component recommends accelerated upland treatment programs to reduce erosion levels from upland soils. Implementation of these programs will protect the soil resource base and provide

overall beneficial effects on environmental quality, although there may be some localized environmental disturbance involved in the initial treatment of upland areas. Reduction in upland erosion will result in a reduction in some non-point source pollution problems, improve agricultural production, reduce damage to fish and wildlife habitat and decrease turbidity levels.

Other recommendations in the Sediment and Erosion Component focus on the collection of additional data to be used to further evaluate the relationship of upland and streambank erosion to the sedimentation of the UMR backwaters. Analyses of this relationship, once determined, can guide development of recommendations to help the backwaters through either mitigative or protective measures.

FISH AND WILDLIFE

The Fish and Wildlife Component focuses mainly on the collection of information to better document and assess impacts to the fish and wildlife resources of the UMR resulting from municipal, residential, industrial, navigational and recreational encroachments. Collection and analysis of this information will permit identification of management techniques that will be used to help provide long-term benefits to the environment.

The Fish and Wildlife Component also recommends the development of an inter-agency committee to coordinate studies and develop programs to manage the fish and wildlife resources of the UMR. This committee will be able to ensure that wise management decisions are made as new data are collected and further conclusions are made, and actions taken.

CULTURAL AND AESTHETIC

The Cultural and Aesthetic Component recommends, primarily, the improved enforcement of existing regulations as they pertain to cultural resources. Protection of cultural resources will almost always result in protection of the environment, although in some cases, this protection may preclude improvement of areas for other environmental benefits.



ON-GOING COORDINATION AND LEGISLATION

The last two sections of the recommended plan deal with On-Going Coordination and Legislation. The On-Going Coordination Section provides for on-going coordination of not only further studies, but also implementation of GREAT II proposed recommendations and any future recommendations. The mechanisms for on-going coordination will help to ensure that the philosophy maintains a balance between environmental protection and economic development. Recommendations numbered 8, 39 and 53, call for on-going coordination through the establishment respectively, of an On-Site Inspection Team (OSIT), a Fish and Wildlife Interagency Committee (FWIC) and an On-Going River Resource Management Team (ORRMT).

The proposed OSIT is a continuation of the OSIT as developed and used in the GREAT II process. The FWIC has not previously existed

except in the concept of the Fish and Wildlife Management Work Group (GREAT II). The ORRMT is also a new structure to operate permanently as the GREAT II Team operated during the GREAT II studies. The ORRMT will operate in coordination with the Upper Mississippi River Basin Commission.

The Legislation Section outlines the additional authority necessary to ensure implementation of many of the GREAT II recommendations, most of which provide for increased protection and/or improvement of water quality.

In general, implementation of the proposed programs and policies is intended to strengthen the ability of federal, state and local agencies to deal with long range planning issues and to diminish the irreversible loss of valuable resources.



PLAN IMPLEMENTATION

chapter

1234**5**



*"The difficult we do immediately,
the impossible takes a little longer."*

Air Force Motto

*. . . if Congress would make a sufficient
appropriation, a colossal benefit would result.*

Mark Twain

The overall goal of the GREAT (I, II and III) studies, collectively, was to develop a total river resource management plan for the Upper Mississippi River. The GREAT studies, in conjunction with the UMRBC—Lock and Dam 26 Master Plan and the UMR Main Stem Level B Study more fully represent the cumulative efforts necessary to complete this massive task. The plans developed by the GREAT II Team are only a portion of this overall effort to develop a total management plan. However, for the GREAT II reach of the

UMR, the GREAT II recommended plan specifies actions (where possible) or delineates studies and programs required as part of a "total management plan". Recommended actions were specified where there were enough available data to draw conclusions, identify alternatives and make recommendations. Further studies were designated where enough data did not exist to draw valid conclusions and identify alternatives. Many of the GREAT II recommendations fall into the category of further study.

As the GREAT II recommended plan contains recommendations requiring further study due to data gaps, the plan is essentially incomplete. In order to ensure that the overall GREAT goal of developing a comprehensive river management plan is attained, the state and federal management agencies must gather sufficient information to fill the data gaps and take steps immediately to implement the actions outlined in the GREAT II Recommended plan. This chapter explains the general responsibilities that state and federal agencies must complete to further develop and refine the UMR management plan.

ON-GOING COORDINATION

The overriding philosophy of GREAT was to promote and improve cooperative, inter-agency and inter-resource working relationships. This improved coordination and cooperation would better provide for system-wide management of *all* of the UMR resources. Inter-agency and inter-resource coordination is especially crucial in present and future societies where the increased populations and accompanying increased demands for goods and services have stimulated an increase in the amounts and types of uses that are required of any single resource. Where overlapping uses occur extra coordination is necessary to ensure that the uses are compatible, and, if not, designed so as not to interfere with the other(s).

As the GREAT studies themselves come to a close, the philosophy of interagency and inter-resource coordination carries on. GREAT II has designated the development and/or continuation of five coordinating bodies to oversee and guide the implementation of the GREAT II recommended plan. These are:

- Continuation of the "Upper Mississippi River Basin Commission" (and its Great River Study Committee)—UMRBC/GRSC.
- Continuation and expansion of the Rock Island District Corps of Engineers

"Committee for Assessment of Regulatory Structures"—CARS.

- Continuation of the GREAT II Team "On-Site Inspection Team"—OSIT, to be chaired by the U.S. Fish and Wildlife Service.
- Development of an "On-Going River Resource Management Team"—ORRMT, to be chaired by a federal agency and a state, initially the RID/COE and the State of Iowa.
- Development of a "Fish and Wildlife Interagency Committee"—FWIC to be chaired by the U.S. Fish and Wildlife Service.

The duties and procedures of the UMRBC, GRSC and ORRMT, as recommended by GREAT II (see recommendation numbers 53 and 54) are general and apply to the entire recommended plan. These same coordinating bodies could and should be used at an even broader level to coordinate the continued development of a total management plan for the UMR through:

- Organization and integration of the results and recommendations of related, on-going or recently completed studies.
- Coordination of the initiation or completion, of recommended studies, as they apply to the objective of developing a total river management plan.
- Coordination and analyses of the data gathered in any additional studies, including a continuous reassessment of any additional data needed.
- Coordination of the implementation of specific-actions delineated by any of the above.

The responsibilities of CARS, OSIT and FWIC, are specific to regulatory structures, dredged material disposal sites and fish and wildlife resources, respectively. The activities of these coordinating bodies would be coordinated with the UMRBC/GRSC and ORRMT.

Successful implementation of the GREAT II recommended plan depends upon early implementation of the recommendations in the plan (Recommendations 8, 43, 52 and 53) that address these five coordinating bodies.

PROCEDURES

The GREAT studies are comprehensive and complex. Consequently, hard and fast guidelines or procedures for implementation cannot be set. At best, implementation of the recommended plan can be discussed in two broad categories: general procedures and specific procedures.

General procedures can be thought of as those steps that a recommendation (or group of recommendations) must follow in order for any agency to implement the recommendation. General procedures are not dependent upon a specific agency or specific recommendation. Rather, general procedures are those that would apply to implementation of any and all of the GREAT II recommendations on a conceptual basis.

Figure 6 depicts the general procedures that will be followed prior to and including implementation.

Specific procedures for implementation are those procedures dependent upon the details of the recommendation and the agency responsible for implementation. These procedures will be defined by the lead agency in their review and analysis of the recommendation.

DESIGNATION OF AGENCY RESPONSIBILITY

The recommendations as developed by the Team, require the following categories of agency responsibility:

- An agency or group of agencies responsible for implementation. (Lead Agency)
- The agencies that the lead agency must coordinate/cooperate with
- Any agencies recommended to serve as participating members on proposed groups or committees. Table VIII summarizes these responsibilities.

LEAD AGENCY

A lead agency is that agency responsible for implementing the recommendation. Lead agencies were selected by the Team, on the

basis of their existing or potential authority. The selection of a lead agency was felt necessary by the Team in order to further define the implementation requirements of the recommended plan and to eliminate possible confusion as to the intended implementing agency.

In many cases, the recommendations as worded in Chapter 3 designate a group of state and/or federal agencies as responsible for implementation. In these cases, the overall intent was to ensure inter-agency coordination prior to implementation of a particular recommendation.

Recommendation 53 calls for the development of the "ORRMT" to provide the mechanism for this coordination. A federal agency and a state representative are to chair the ORRMT. The RID/COE and the state of Iowa have been designated as the initial co-chairs of the ORRMT, (FY81) and have therefore been designated as the lead agencies for all recommendations requiring inter-agency coordination (see Table VIII). In these cases the responsibilities of the RID/COE and the state of Iowa as lead agencies, are only those of coordination. Each participating agency on the ORRMT will be responsible for seeking the funding necessary to implement any recommendations that result through the ORRMT coordinating process. The co-chair responsibilities of the RID/COE and the state of Iowa may be revised by the ORRMT at any time after their organizational meeting.

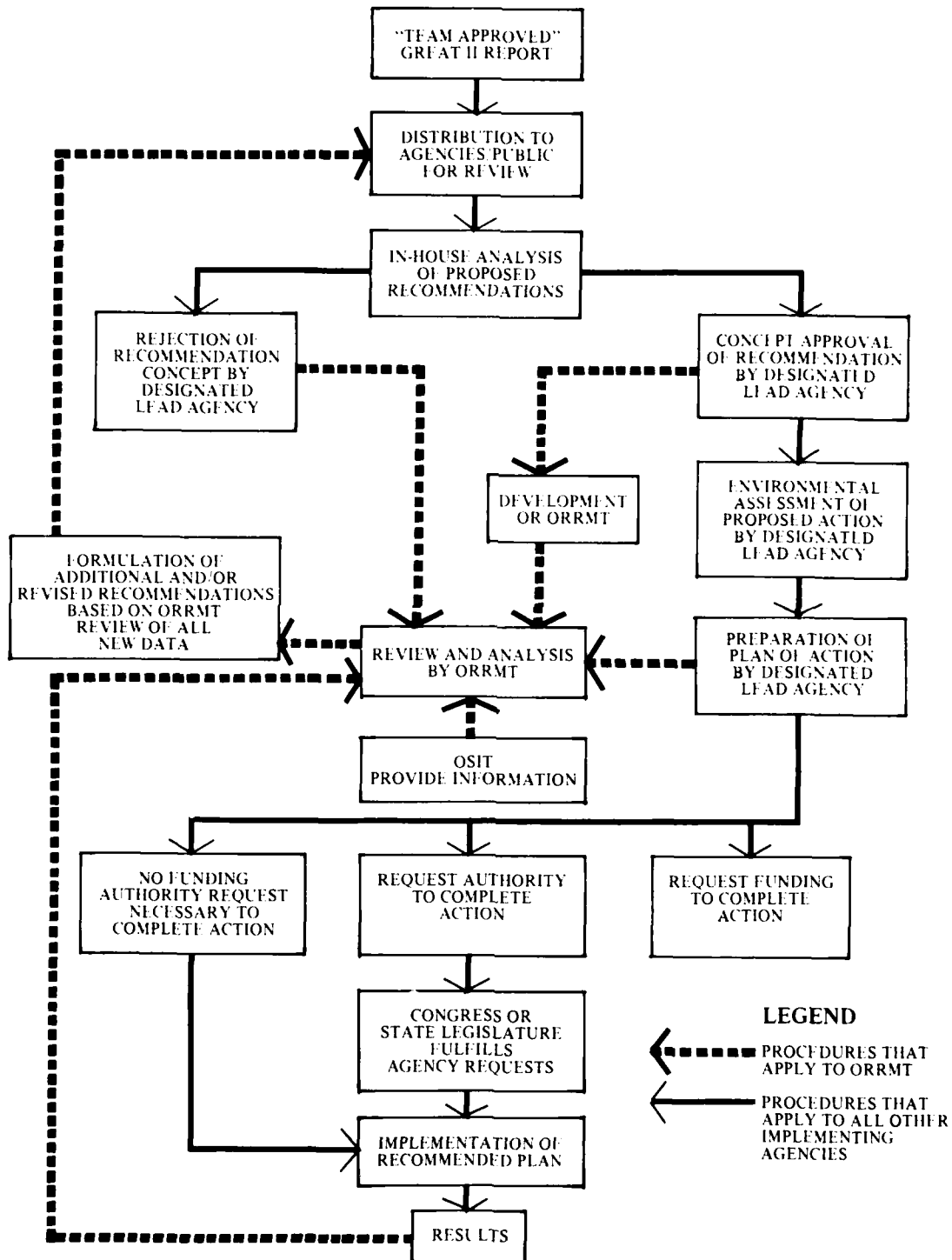
COORDINATING/ COOPERATING AGENCY

A lead agency will be responsible for "coordinating" information and plan development with the agencies indicated on Table VIII. Correspondingly, these agencies are expected to "cooperate" with the lead agency in the collection or distribution of data and/or the review and analysis of the lead agencies plans for implementation.

PARTICIPATING MEMBER

Recommendations that require agency participation on a committee or decision making group are displayed in Table VIII.

FIGURE #6
GENERAL IMPLEMENTATION PROCEDURES



L=Lead
C=Cooperating/Coordinating
PM=Participating Members

TABLE VIII-1
IMPLEMENTATION RESPONSIBILITY

FINAL RECOMMENDATION NUMBER	RID/ COE	NCD/ COE	USFWS	USDOT/ USCG	USEPA	USDA	USGS	WIS- CONSN	IOWA	ILL- NOIS	MIS- SOURI	UMRBC	CON- GRESS	OTHER
1	L													
2		L												
3				L										
4	C			L										
5				L										
6	L		C					C	C	C	C			NOTE C: State DOT's
7	L		C					C	C	C	C			
8	L		L*	PM*	PM*	PM*		PM*	PM*	PM*	PM*			NOTE: *OSIT
9	L			C	C	C		C	L	C	C	C		
10								C	L	C	C			
11	L											C		
12	L		C			C		C	C	C	C			
13	L													
14	C		C	C				C	L	C	C	C		UMRCC
15								C	L	C	C			
16	C		C					C	L	C	C	C		
17	L		C					C	L	C	C	C		
18	L		C	C	C	C		C	L	C	C	C		
19	C		C	C		C		C	L	C	C	C		

L=Lead
C=Cooperating/Coordinating
PM=Participating Members

TABLE VIII-2
IMPLEMENTATION RESPONSIBILITY

FINAL RECOMMENDATION NUMBER	RID/ COE	NCD/ COE	USFWS	USDOT/ USCG	USEPA	USDA	USGS	WIS- CONSN	IOWA	ILL- NOIS	MIS- SOURI	UMRBC	CON- GRESS	OTHER
20								C	L	C	C			
21	L		C	C	C	C	C	C	L	C	C	C		
22	L		C		C			C	L	C	C			
23	C				L			C	C	C	C			
24				C	L			C	C	C	C			
25	C				L			C	C	C	C			
26					L			C	C	C	C			
27					L		C							
28					C			C	L	C	C			
29					L			C	C	C	C			
30								C	L	C	C			
31	L			C	C	C	C	C	L	C	C			
32				L										
33			L	C	C			C	C	C	C			
34						L		C	C	C	C			
35	C				C	C	L	C	C	C	C			
36	L				C			C	C	C	C			
37	L		C					C	C	C	C			
38	L							C	C	C	C			

TABLE VIII-3

IMPLEMENTATION RESPONSIBILITY

L=Lead
C=Cooperating/Coordinating
PM=Participating Members

FINAL RECOMMENDATION NUMBER	RID/ COE	NCD/ COE	USFWS	USDOT/ USCG	USEPA	USDA	USGS	WIS- CONSN	IOWA	ILL- NOIS	MIS- SOURI	UMRBC	CON- GRESS	OTHER
39	PM*		L*					PM*	PM*	PM*	PM*	C		*FWIC UMRCC C UMRCC C
40	C		L					C	C	C	C			
41	L		C			C		C	C	C	C			
42	L		C					C	C	C	C			UMRCC C
43	L		L					C	C	C	C			
44	L		C					C	C	C	C			
45	L		C	C	C	C		C	L	C	C			
46	L		C			C		C	C	C	C			
47		L						C	C	C	C			L HCRS
48								C	C	C	C			
49	L		C	C	C	C		C	L	C	C	C		
50	L		C	C	C	C		C	L	C	C	C		
51	L													
52												L		
53	L*		PM*	PM*	PM*	PM*		PM*	L*	PM*	PM*	C		*ORRMT
54	L*		PM*	PM*	PM*	PM*		PM*	L*	PM*	PM*	C		*ORRMT
55													L	
56													L	

IMPLEMENTATION PRIORITIES

Specific priorities for all GREAT II recommendations were difficult to determine because of the multitude of interests represented by the member agencies. Five recommendations were selected as high priority because of their significance to the implementation of other GREAT II recommendations.

Recommendations 39, 52, 53 and 54, all address the need for on-going coordination. Implementation of these recommendations is essential to the implementation of most of the remaining GREAT II recommendations and are therefore considered "high" priorities.

Recommendation 8 addresses the plans contained in the Channel Maintenance (CM) Handbook. The Channel Maintenance Plans received the largest single amount of study by the GREAT II Team. The plans and studies of the CM Handbook are also considered a "high" priority.

The ORRMT and other appropriate agencies will be responsible for determining priorities of the remaining 51 recommendations. Agency comments regarding priorities will be provided to the ORRMT. Special implementation considerations for the 5 high priority recommendations are discussed below.

RECOMMENDATION 8. The recommendation calls for implementation of the Channel Maintenance Handbook. The CM Handbook, among other things, identifies the members and the operating procedures of OSIT, and the obligatory coordination with the ORRMT. All agencies represented on the GREAT II Team would be represented and therefore able to participate on the OSIT. The USFWS is responsible for chairing the OSIT. Agency participation on the OSIT is essential to its success as a body to aid the RID/COE in implementing a dredged material disposal plan. Special considerations for implementation of the dredged material disposal plan are necessary in the State of Wisconsin. For specific dredged material disposal sites listed in the CM Handbook on Wisconsin lands, Wisconsin must seek legislative exemption for those disposal sites which would presently violate laws and policies of the state.

RECOMMENDATION 39. The USFWS will be responsible for organizing and chairing a new coordinating group entitled the Fish and

Wildlife Interagency Committee (FWIC). Member agencies should include the GREAT II States and the RID/COE. Member agencies should designate an agency representative and request necessary appropriations from Congress or state legislatures for participation. The USFWS will be responsible for insuring that all FWIC activities are closely coordinated with plans of the ORRMT. All FWIC decisions should be distributed to ORRMT member agencies for review and comment.

RECOMMENDATION 52. The UMRBC will be responsible for utilizing the information gathered in GREAT II and in the Great II recommended studies to further complete a management plan for the UMR. The UMRBC will be responsible for closely coordinating plans and information with the ORRMT. The UMRBC will provide guidance to the ORRMT from the broader spectrum of the entire UMR. The UMRBC should be prepared to aid in the funding of programs and studies as recommended by the ORRMT.

RECOMMENDATION 53. Organization of the ORRMT is crucial to implementation of Recommendations 9, 10, 14, 15, 16, 17, 18, 19, 21, 28, 30, 31, 49, 50, 53, and 54. The RID/COE will be responsible for immediately coordinating with the State of Iowa to set up the organizational meeting of the ORRMT. All proposed member agencies of the ORRMT are responsible for designating and funding their agency representative. The organizational meeting will be to develop the operating procedures and schedules of the ORRMT. Further meetings will be called by the ORRMT co-chairs to begin coordinating implementation of the GREAT II recommendations.

RECOMMENDATION 54. The co-chairmen of the ORRMT will be responsible for coordinating the development of a comprehensive computerized resource information system for the UMR. Member agencies of the ORRMT will be responsible for participating in developing the system and for insuring that information generated from within their agency is made available to the system. Funding for the data system will be the responsibility of the UMRBC.



“To safeguard the future of the Mississippi River, it takes more than a plan. It takes support from people who care. We are free to choose—action or inaction, self-interest or self-sacrifice.”

Unknown

ACCOMPANYING DOCUMENTS

The following list of documents are those prepared by or for the GREAT II Team. These documents and supporting references are available at the RID/COE and public libraries. They are not intended to receive the same distribution as this report.

1. Executive Summary
2. Supplements to this report:
 - Channel Maintenance Handbook
 - Environmental Report
3. Work Group Appendixes to this Report
 - Plan Formulation Technical Appendix & Addendum (PFWG)
 - Commercial Transportation Work Group (CTWG) Appendix
 - Cultural Resources Work Group (CRWG) Appendix
 - Dredged Material Uses Work Group (DMUWG) Appendix
 - Dredging Requirements Work Group (DRWG) Appendix
 - Fish and Wildlife Management Work Group (FWMWG) Appendix
 - Floodplain Management Work Group (FPMWG) Appendix
 - Material and Equipment Needs Work Group (MENWG) Appendix
 - Public Participation and Information Work Group (PPIWG) Appendix
 - Recreation Work Group (RWG) Appendix
 - Sediment and Erosion Control Work Group (SECWG) Appendix
 - Side Channel Work Group (SCWG) Appendix
 - Water Quality Work Group (WQWG) Appendix
4. Work Group Products and/or Contract Reports:

(Please refer to the appropriate work group appendix for a complete reference of the documents listed below.)

 - PFWG:
 - "Commercial River Use"—Contract Report
 - CTWG:
 - "Bridges in the GREAT II Area"—Work Group Product
 - "GREAT II Fleeting Area Survey"—Work Group Product

"Barge Traffic Forecast and Constraint Analysis for the GREAT II Area"—Contract Report

"Relationship of Underkeel Clearance and Vessel Speed to Groundings"—Contract Report

"Commercial Vessel Safety—Accidents, Hazardous Materials and Double Bottoms"—Work Group Product, published in CTWG Appendix

"Impacts of Commercial Transportation—Bank Erosion and Turbidity."—Work Group Product, published in CTWG Appendix

"Fuel Consumption Affected by Channel Depth"—Work Group Product, published in CTWG Appendix

"Impacts of Channel Maintenance on Commercial Vessels"—Work Group Product, published in CTWG Appendix

• CRWG:

"Cultural Resources of the Upper Mississippi Valley"—Contract Report

"An Overview of the Effects of Inundation on Archaeological Sites Along the Mississippi River"—Work Group Product, Unpublished

• DMUWG:

"Waste Dredge Material for Construction"—Contract Report

"State and Federal Restrictions on Dredge Spoil Placement In the Upper Mississippi River Area"—Work Group Product, published in part in DMUWG Appendix

"Potential Market Demand for Dredged Material in the Upper Mississippi River Area"—Work Group Product, published in Part in DMUWG Appendix

• DRWG:

"Field Study of Sediment Transport Characteristics of the Mississippi River Near Fox Island and Buzzard Island"—Contract Report

"Field Study of Sediment Transport Characteristics of the Mississippi River Near Buzzard Island"—Contract Report

"Planning of a Demonstration Project for Main Channel Disposal of Dredged Material"—Contract Report

- FWMWG:
 - "Upper Mississippi River Wing Dam Notching Study; the Pre-Notching Fish Study"—Contract Report
 - "Influence of Wing-Dam Notching on Aquatic Macro-Invertebrate in Pool 13 of the Upper Mississippi River—The Pre-Notching Fish Study"—Contract Report
 - "A Classification of the Wing and Closing Dams on the Upper Mississippi River Bordering Iowa"—Contract Report
 - "A Classification of the Wing and Closing Dams on the Upper Mississippi River Bordering Iowa"—Contract Report
 - "Evaluation of Physical Information Gathering Methods for the Upper Mississippi River; Stages 1 and 2"—Contract Report
 - "Fish and Wildlife Management Work Group Annotated Bibliography"—Contract Report
 - "Literature Review of Fish and Wildlife Resources, Annotated Bibliography"—Contract Report
 - "Progress Report for Influence of Wing Dike Notching on Aquatic Community Characteristics in Pool 13 of the Mississippi River"—Contract Report
 - "Study of Fish in the Main Channel of the Mississippi River Between R.M. 500 and 513"—Contract Report
 - "Dredged Material Disposal Plan Habitat Evaluation"—Work Group Product, published in FWMWG Appendix
- FPMWG:
 - "Legal and Institutional Framework Study of the Upper Mississippi River Floodplain—for the Great (II) River Environmental Action Team"—Contract Report
 - "Floodplain Delineation on Base Maps"—Contract Product, published in FPMWG Appendix
 - "Standard Flood Profiles for the Upper Mississippi River"—Work Group Product, published in FPMWG Appendix
 - "Model Legislation"—Work Group Product, published in FPMWG Appendix
- MENWG:
 - "Great II Dredging Equipment Review"—Contract Report
- PPIWG:
 - "GREAT Is Reaching Out to the People"—Contract Report
 - "GREAT . . . Responds to the People"—Contract Report
 - "GREAT II . . . A Summary of Public Concerns"—Contract Report
 - "1980 Town Meeting Report"—Contract Report
 - "GREAT II—PPIWG Workshop Report"—Work Group Product
 - "Phase B Report—FY '78"—Contract Report
 - "Phase C Report—FY '79"—Contract Report
 - "PPIWG Executive Board Meeting Minutes"—Work Group Product
 - "River Currents Newsletters"—Contract Product
- RWG:
 - "Recreation Use Projection and Needs Report"—Work Group Product
 - "Boating Safety Analysis"—Work Group Product
 - "GREAT II Recreation Facility Inventory"—Work Group Product
 - "Bibliography of Selected Literature on the River Recreation (Partially Annotated)"—Contract Report
 - "Determining Means of Enhancing and Maintaining Recreation Areas with Dredged Material"—Contract Report
 - "Marinas on the Upper Mississippi River: A Supplement to the GREAT II Dredged Material Disposal Site Recreational Use Assessment"—Contract Report
 - "GREAT II Dredged Material Disposal Site Recreational User Assessment"—Contract Report
 - "Follow-Up Recreation Survey Results to 1978 On-Site Recreation Survey Results: A Supplement to the GREAT II Dredged Material Disposal Site Recreational User Assessment"—Contract Report
 - "Monitoring the Use of the Waterways with Aerial Photography; the Development, Testing and Evaluation of a Computer Assessor Methodology"—Contract Report

- SECWG:
 - "Sediment Budget Study for the Upper Mississippi River, GREAT II Reach"—Contract Report
 - "Assessment of Available Field Sedimentation Data for GREAT II Watershed"—Contract Report
 - "Bed-Load Data"—Unpublished Work Group Product
- SCWG:
 - "A Study on the Effects of Diverting Water into Upper Burnt Pocket, Navigation Pool No. 18, Illinois, and a Field Test of the Regression Simulation Model Previously Developed on Navigation Pool No. 8"—Contract Report
 - "Fish Communities in Mississippi River Side Channels"—Contract Report
 - "Limnology of Three Backwaters in Different Seral Stages in the Upper Mississippi River"—Contract Report
 - "Factors Affecting Fish Community Structure and Habitat Preferences in Upper Mississippi Backwaters"—Contract Report
- WQWG:
 - "Desorption of Pollutants from Mississippi River Sediments in the GREAT II Study Reach"—Contract Report
 - "Water Quality Assessment Report"—Work Group Product
 - "Suspended Sediment Modeling of Dredge Disposal Effluent in the GREAT II Study Reach"—Contract Report

GLOSSARY OF TERMS

Accretion Creation of fast land

Adsorption Adhesion of molecules to a surface.

Aggradation A process of raising the elevation of a surface by the deposition of sediment.

Alluvial Channel A channel whose bed is composed of non-cohesive sediment that has been or can be transported by running water.

Alluvium (Alluvial Deposit) Clay, silt, sand, gravel, pebble, or other detrital material deposited by water.

Ambient The prevailing or surrounding condition.

Anaerobic Without air or free oxygen.

Aquatic Habitat Habitats in the GREAT II reach supporting aquatic species on the UMR. These habitats include the main channel, main channel border, tailwaters, side channel, river, lakes and ponds, and sloughs (see FWMWG Appendix for further definition).

Backwaters A general term for off-channel aquatic areas.

Bank The margins of a channel. Banks are called right or left, as viewed facing the direction of the flow.

Barge A flat-bottomed vessel, usually nonself-propelled, used chiefly on inland waterways.

Barge Tow One or more barges attached together and either pushed or pulled by a tow boat.

Bed (Streambed) The bottom of a water course.

Bed Load That part of the total sediment load that moves by rolling or sliding along the bed.

Bed Material The material of which a streambed is composed.

Beneficial Use Site A site where dredged material can be used for productive purposes.

BOD (Biochemical Oxygen Demand) The amount of oxygen in water which is utilized in the bacterial decomposition of organic matter.

Carrying Capacity The limit of a natural ecosystem's ability to sustain its inhabitants OR the maximum level of vessel traffic economically or physically supported by the river as determined by natural or man-made constraints.

Channel (1) The deepest portion of a river bed, in which the main current flows. (2) A natural or artificial, clearly distinguished, waterway which periodically or continuously contains moving water, or which forms a connecting link between two bodies of water.

Channel Maintenance The operation and repair of the locks and dams, the repair and/or construction of channel control structures and the dredging and disposal of materials from the main channel and small boat harbors.

COD (Chemical Oxygen Demand) A measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water. The COD test is used to determine the degree of pollution in a body of water especially from industrial waste and waste treatment plants.

Clean Water Act Federal Water Pollution Control Act as amended by Clean Water Act of 1977 (PL 95-217)

CTWG Commercial Transportation Work Group

CARS Committee for Assessment of Regulatory Structures

Compensation Replacing or providing substitute resources or environments.

Confined Permanent removal of dredged material from the riverine environment by enclosure in impermeable structures.

Conservation The continuing protection and management of natural renewable resources (i.e., soil, water, wildlife, forest), in accordance with principles that assure their optimum economic and social enjoyment.

Contained The use of temporary dikes or earth works to control material and return water during dredging.

COE Corps of Engineers, Department of the Army

Cross-Section (of a Stream) That section of the stream at right angle to the main (average) direction of flow.

Cubic Feet per Second (ft³/sec) A unit expressing rates of discharge. One cubic foot per second is equal to the discharge of a stream of rectangular cross section, 1 foot wide and 1 foot deep, flowing water an average velocity of 1 foot per second.

Cultural Resource This is a broad descriptive term encompassing any object, site, district, place, building, or structure which may contain or has been demonstrated to contain data, information, or value in understanding the human past.

CRWG Cultural Resources Work Group

DOT Department of Transportation, State of Federal transportation agency.

Desorption Removal of molecules from a surface.

Discharge Same as "Cubic Feet per Second"

Disposal, Open Water The disposal of dredged material on aquatic habitat

DSSTF Disposal Site Selection Task Force

Disposal, Thalweg The disposal of dredged material into the main channel.

Diversity, Species The number of different species occurring in a given location or under a given condition. Diversity has been directly associated with ecologic stability.

Double-Lockage Breaking one tow into two sections for lock passage, i.e., 1200 foot tow through a 600 foot lock.

Draft Depth below the waterline that the vessel is submerged.

Drainage Basin See "Watershed"

Dredge Cut River bottom area usually in the main channel delineated for removal of accreted sediments.

Dredged Material The excavated material from dredging operations (also sometimes referred to as dredged spoil).

DMUWG Dredged Material Uses Work Group

Dredging A process by which sediments are removed from the bottom of streams, lakes, and coastal waters, transported by ship, barge, or pipeline, and discharged in open water or on land

- DRWG** Dredging Requirements Work Group
- EA** Environmental Assessment as required by NEPA
- EIS** Environmental Impact Statement as required by NEPA
- EPA** Environmental Protection Agency State or Federal agency
- EQ** Environmental Quality. As defined in P&S: The management, conservation, preservation, creation, restoration or improvement of the quality of certain natural and cultural resources and ecological systems.
- Environmental Threshold** That point past which the environment will not return to its original condition.
- Erosion** The group of processes whereby earthy or rock material is worn away, loosened or dissolved and removed from any part of the earth's surface. It includes the processes of weathering, solution, corrosion and transportation.
- Eutrophication** A process of increasing nutrient levels and aquatic plant growth in lakes or streams.
- FDA** Food and Drug Administration
- FEMA** Federal Emergency Management Agency
- FRA** Federal Railroad Administration, U. S. Department of Transportation
- FWIC** Fish and Wildlife Interagency Committee
- FWMWG** Fish and Wildlife Management Work Group
- Flat Pool** Theoretical base level that would be achieved in a dammed, pooled river at zero flow.
- Fleeting Area** A permanent facility within defined boundaries used to provide barge mooring service and ancillary harbor towing under the care of the fleeting operator. Momentary anchoring or tieing off of tows in transit and under the care of the line-haul towboat is not included.
- Floodplain** A strip of relatively smooth land bordering a stream, built of sediment carried by the stream and dropped in the slack water beyond the influence of the swiftest current.
- FPMWG** Floodplain Management Work Group
- Floodway** A part of the floodplain which, to facilitate the passage of floodwater, is kept clear of encumbrances.
- Flow** The movement of water downstream.
- Fluvial** Of or relating to rivers.
- Geomorphology** The study of the form of the earth's surface.
- GIS** Geographic Information System.
- GREAT** Great River Environmental Action Team.
- GRSC** Great River Study Committee of the UMRBC
- Guidewall** An extension of a lock that provides guidance for approaching vessels and permits mooring for breaking and making tows for double lockages.
- HU** Habitat Units (see Mitigation section in the CM Handbook)
- HCRS** Heritage Conservation Recreation Service, U.S. Department of the Interior
- Hydraulics** The science of laws governing water or other liquids in motion and their applications in engineering.
- Hydrograph** A graph which shows changes in discharge of a watercourse over time.
- Hydrology** A science dealing with the properties, distribution and circulation of water.
- IOC** Internal Overview Committee of GREAT II.
- LAWCON** Land and Water Conservation Fund administered by HCRS as grant-in-aid (P.L. 88-578)
- Lerree** A water-retaining earthwork used to confine streamflow within a specified area along the stream or to prevent flooding due to high water or waves.
- Lerree, Natural** Low alluvial ridge adjoining the channel of a stream composed of sediment deposited by flood water which has overflowed the banks of the channel.
- Lock** An enclosed part of a canal, waterway, etc., equipped with gates so that the water level can be changed to raise or lower boats from one height to another.
- LOI** Lowest operating level (same as flat pool).
- Main Channel** This includes only the portion of the river through which the large commercial craft can operate. It is defined by combinations of various channel control structures, natural features, and navigation markers. It has a minimum depth of nine feet and a minimum width of 300 feet.
- MENWG** Material and Equipment Needs Work Group.
- Mitigation** That planning process which (1) avoids impacts altogether by not taking a certain action or parts of an action, (2) minimizing impacts by limiting the degree or magnitude of the action and its implementation, (3) rectifying the impact by repairing, rehabilitating, or restoring the affected environment, and (4) reducing or eliminating the impacts over time by replacing or providing substitute resources or environments.
- NED** National Economic Development. As defined in P&S: Increasing the value of the nation's output of goods and services and improving national economic efficiency.
- NEPA** National Environmental Policy Act (PL 91-190). Act requires federal agencies to prepare an impact statement on all proposed actions which would significantly affect the quality of the environment.
- National Historic Preservation Act** Public Law 86-665, approved October 15, 1966, an "Act to establish a program for the preservation of additional historic properties throughout the Nation and for other purposes."
- NPDPS** National Pollution Discharge Elimination System. A national system of wastewater discharge permits required by Section 402 of the Clean Water Act.
- National Register of Historic Places** A register of districts, sites, buildings, structures and objects of national, state or local significance in American history, architecture, archaeology, and culture that is expanded and maintained by the Secretary of the Interior under authority of Section 2(b) of the Historic Sites Act of 1935 (49 Stat. 666, 16 U.S.C.

- 461) and Section 101(a)(1) of the National Historic Preservation Act implemented through 36 CFR Part 60.
- Navigation Channel* Same as "Main Channel" except that it also includes natural or man-made auxilliary channels used by either commercial or recreational vessels.
- Navigation Depth* The depth provided for safe navigation by vessels with a given draft.
- Navigation Width* The width provided for safe passage of vessels with a given draft.
- NCD COI* North Central Division Corps of Engineers, Department of the Army
- OSIT* On-Site Inspection Team
- ORRMT* On-Going River Resource Management Team
- Overdepth Dredging* Dredging allowances required for advanced maintenance dredging, channel alignment, dredging tolerances, squat and trim for the class of vessel using the project, wave action, shoaling rates, and other allowances necessary to afford safe navigation. Past dredging practices sometimes exceeded the depths necessary to provide for safe navigation.
- Pilot* Operator of a motor vessel who controls the vessel's movements.
- PREP* Plan Formulation Report, Evaluation and Preparation Task Force
- PFWG* Plan Formulation Work Group
- POA* Plan-of-Action
- PCB* Polychlorinated biphenols
- P&S* Principles & Standards established by the Water Resources Council in Federal Register, Vol. 38, Do. 174, September 1973.
- PPIWG* Public Participation and Information Work Group
- RRT* Regional Response Team (see FWMWG Appendix recommendation)
- RFFP* Removed from Flood Plain
- RM* River Mile. A reference unit along the river thalweg or main-flow path. On the UMR measured upstream from the confluence with the Ohio River.
- River Width* The distance between vegetated banks taken perpendicular to the general direction of flow in the river.
- RID COI* Rock Island District/Corps of Engineers, Department of the Army
- Sediment* Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity or ice and has come to rest on the earth's surface either above or below sea level.
- SCCWG* Sediment and Erosion Control Work Group
- Sediment Discharge* The quantity of sediment, measured in dry weight or by volume, transported through a stream cross-section in a given time. Includes bed load and suspended load.
- Sequenced Locking* System of locking two or more tows in one direction before locking in the reverse direction, to achieve increased lock efficiency.
- Shoaling* The creation of a shallow area by a sand wave or bar.
- Side Channel* All departures from the main channel and main channel border in which there is current during normal river stage.
- SCW/G* Side Channel Work Group
- Slough* Departure from the main channel or a side channel in which there is little or no current during normal river stages.
- SCS* Soil Conservation Service, U. S. Department of Agriculture.
- Stage* The height of a water surface above an established datum plane. Also gage height.
- SCORP* State Comprehensive Outdoor Recreation Plan under the provisions of LAWCON.
- SHPO* State Historic Preservation Officer. The official, who is responsible for administering the National Historic Preservation Act within the state, or a designated representative authorized to act for the State Historic Preservation Officer. These officers are appointed pursuant to 36 CFR 61.2 by the Governor of the state.
- Stockpile Site* A disposal site where dredged material is temporarily placed until it is removed for beneficial use.
- Survey, Cultural Resource* A field action which locates, identifies, and evaluates cultural resources; it is normally designed in advance and reports of surveys are normally made as part of the documentation of the survey.
- Suspended Load* Sediment material transported in the water column.
- Suspended Solids* A measure of the amounts of solids which are in the water column.
- Tailwater* The water located just downstream from a hydraulic structure on a stream (i.e., a dam).
- Terrestrial Habitat* Habitat supporting terrestrial species. In the GREAT II reach these have been described as including the following: wetlands, lowland hardwoods, agricultural fields, levees, old fields, mowed grass, breached levee, dredged material and developed areas (See Channel Maintenance Handbook for more complete description of these types).
- Thalweg* The line following the deepest part of a streambed or channel.
- Thermal Plume* A discrete three-dimensional area of heated water within a river, lake, etc.
- Tonnage* Number of tons of freight carried in a vessel, passing through a lock, or handled by a terminal.
- Turbidity* The condition of a liquid due to fine, visible material in suspension which impedes the passage of light through the liquid.
- UMR* Upper Mississippi River. The Mississippi River from Cairo, Illinois to the head of navigation in St. Paul, Minnesota.
- UMRBC* Upper Mississippi River Basin Commission. A state and federal partnership operating under the U.S. Water Resources Council.
- UMRCC* Upper Mississippi River Conservation Committee. A partnership of state conservation agencies.
- UMRWLFR* Upper Mississippi River Wild Life and Fish Refuge.

USCG U. S. Coast Guard, U. S. Department of Transportation

USDA U. S. Department of Agriculture

USFWS U. S. Fish and Wildlife Service, U. S. Department of the Interior

USGS U. S. Geological Survey, U. S. Department of the Interior

WQWG Water Quality Work Group

Water Surface Profile The elevation of the water surface at a series of points along a river channel.

WES Waterways Experiment Station, U. S. Army Corps of Engineers, Department of the Army

Watershed The total area above a given point on a stream that contributes water to the flow at that point. The entire region drained by a waterway.

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